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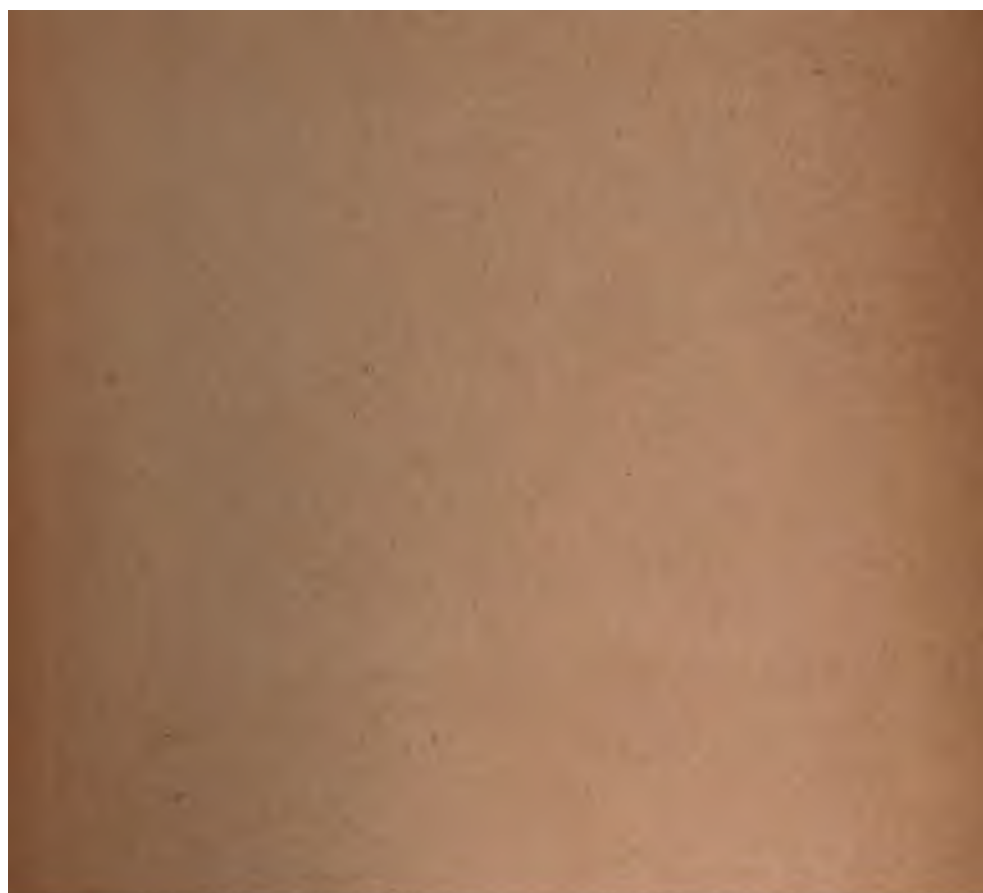
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A TEXT-BOOK  
OF  
**UROLOGY**  
IN  
WOMEN AND CHILDREN

INCLUDING URINARY AND SEXUAL INFECTIONS  
URETHROSCOPY AND CYSTOSCOPY

BY

**W. COX PEDERSEN, A.M., M.D., F.A.C.S.**

MAJOR, UNITED STATES ARMY; CONSULTING PHYSICIAN TO THE SELECTIVE  
QUARTERS IN THE CITY OF NEW YORK; MEMBER OF THE COUNCIL OF  
DEFENSE, NEW YORK STATE COMMITTEE, MEDICAL SECTION;  
UROLOGIST TO ST. MARK'S HOSPITAL; MAJOR, MEDICAL  
RESERVE CORPS, UNITED STATES OF AMERICA.

MEMBER, UROLOGICAL ASSOCIATION, AMERICAN MEDICAL ASSOCIATION,  
AND COUNTY MEDICAL SOCIETIES, NEW YORK ACADEMY OF  
ELECTROTHERAPEUTIC ASSOCIATION, THE ASSOCIATION  
OF PHYSICIANS OF THE UNITED STATES, AND OF THE COMMITTEE  
ON DISEASES OF THE ADVISORY COUNCIL OF THE  
DEPARTMENT OF HEALTH OF NEW YORK CITY

62 ENGRAVINGS, OF WHICH 152 ARE ORIGINAL  
AND 13 COLORED PLATES



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IN MEMORY  
OF  
WILLIAM WALTER GENGE, M.D., C.M.  
WHO  
AMID THE DIFFICULTIES AND TRIALS OF PRACTICE  
IN THE GREEN MOUNTAINS OF VERMONT  
FIRST TAUGHT THE INSPIRATION AND BLESSING IN A  
LIFE SPENT IN THE SERVICE OF MANKIND  
AND  
IN GRATITUDE  
TO  
WALTER BROOKS BROUNER, A.B., M.D.  
WHO  
THROUGH A HUMAN GENERATION  
HAS SHOWN A  
PERSONAL AND PROFESSIONAL FRIENDSHIP WHICH  
HAS NEVER FALTERED NOR FAILED,  
THIS BOOK  
IS SINCERELY DEDICATED

47262



## PREFACE.

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IN preparing a text-book on any branch of medicine originality, except perhaps in arrangement, is almost impossible.

The present work is planned on a rather uniform discussion of the clinical side of the diseases included, for the benefit of students and general practitioners, who, in not being widely familiar with the subjects, will be served by a fixed view-point. The reader will perceive this outline in such subjects as etiology, pathology, symptoms, diagnosis and treatment. A further advantage of this method is that these five subjects are correlated unmistakably by it—a fact which also assists the student.

The disadvantage of fixed structure is a varying amount of similarity of style in passing from one disease to another or from one chapter to the next, but the effort has been made to correct this disadvantage by variations in diction.

The usual paragraphs on course and prognosis have been omitted as separate subjects but have been carefully embodied in symptomatology as parts of "termination" of each disease. The stages of incubation, invasion, establishment and termination are described so that the student receives a word-picture of the important affections and learns the course and prognosis not as afterthoughts, but as integral elements of the various cases. For the same reason, complications are mentioned during "termination" of the primary disease. The complications have, however, individual portions of the text because in turn their stages of development, progress and cessation are detailed.

Under diagnosis in the subject of functional test of the kidneys, hematology has been included as one of the latest additions to our knowledge and as one of the most accurate methods. Authorities are quoted as to the normal range of urea, uric acid, creatinin, sugar, cholesterin and urinary salts, and also as to pathological proportions and their causes. Doubts as to values are clearly verified and explained.

Physical treatment is certainly in the ascendant. The next generation will see it more and more amplified, not to supplant but to augment

other methods. A familiar example is the use of Roentgen rays and radium, and less usual at present are hydrotherapy, heliotherapy and electrotherapy. In human nature the average criticism is adverse and destructive, while relatively few are favorable and constructive. Nearly every urologist who discourages physical treatment is not possessed of the necessary apparatus, and therefore cannot say from his own experience more than that he obtains good results from other methods. The writer is not content and believes that the profession should not be satisfied with noncommittal inexperience. He therefore determined to have physical treatment well discussed in his work, and is indebted to Dr. Edward C. Titus, one of the well-known American authorities, for suggestions and additions. Those who have not tried physical methods are thus aided to do so in good faith and with encouragement, because when compared with drugs and chemical methods, their action is far more definite and more under control of the physician at all times.

The data on physical treatment comprise hydrotherapy, heliotherapy and electrotherapy. It has been the design to outline proper cases for one or all these methods, the suitable machine and instruments, the type of application, the strength of application and the duration and frequency of the treatment. To these facts have been added aftercare and adjuvants. In this way a reliable foundation has been given to the student and the practitioner for the judicious and comprehensive treatment by these methods of cases properly selected.

Under the heading of treatment, aftertreatment is carefully considered, because the average student learns little of it and general practitioners neglect aftertreatment in whole or in part. This subject is subdivided into immediate aftertreatment, comprised chiefly in bed care; and remote aftertreatment, which is provided mainly by attention in the office. It is felt that these principles of following cases for long periods after immediate discharge will result in a far higher percentage of complete cures and a larger average of cures without relapses and without sequels.

In separate paragraphs in all diseases, the standard of cure is briefly stated, so that the student and the general practitioner will understand exactly what degree of relief should be reached before the patient is discharged from treatment. So far as the author knows, such brief discussions of the standard of cure do not occur in any other work.

In order to do justice to other authorities, every quotation and

illustration is accompanied by a verified reference in literature. For the detail of these verifications, the author is indebted to Dr. Edward Preble.

Nearly all the  $\alpha$ -ray work of this volume has been executed by Dr. Byron C. Darling, to whom great appreciation is hereby offered.

The writer is personally indebted for advice and encouragement to his life-long friend, Dr. Walter B. Brouner, and to his associates in St. Mark's Hospital, Dr. Benjamin T. Tilton and Dr. Charles R. L. Putnam, and particularly among the members of his own staff, to Dr. Alexander Alexion and to the late Dr. Joseph Kaufman. Numerous friends have loaned illustrations and notes of cases, for which credit has been given in the text and for which gratitude is now extended.

This book represents the experience of many years in urological departments in New York City, in private practice and in the author's clinic at St. Mark's Hospital. The actual production of the manuscript and illustrations required four years of consistent and concentrated effort. If the outcome has become a serviceable and accurate book, the time and energy thus expended will be more than amply repaid.

V. C. P.

45 WEST NINTH STREET,  
NEW YORK CITY.





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# A TEXT-BOOK OF UROLOGY.

## CHAPTER I.

### ACUTE URETHRITIS.

**Anatomy.—Importance.**—In a work on the clinical features and treatment of disease detailed anatomy can have no place. The reader is therefore referred to works on gross anatomy and on normal and pathological minute anatomy. The basic principle must never be forgotten in dealing with infections of the sexual and urinary systems that there exists continuity of all the organs of both systems through continuity of their mucous membrane linings. This relation exists between the organs of each system in itself and between the organs of both systems in their correlation.

**Gross Anatomy.**—In the urinary system are the excretory centers in the kidneys and a continuous passage from the pelvis to the meatus varied in caliber according to function. Dilatation for collection is seen in the renal pelvis and the urinary bladder and more or less cylindrical reduction for transmission is evident in the ureters and urethra. In the sexual system the secretory glands are the testes and may be regarded as possessing continuous canals from the epididymes to the meatus. The function varies with the caliber. Collection is slightly provided for in the epididymes and ampullæ of the vasa deferentia and freely in the seminal vesicles. Evacuation is procured between these points by the vasa deferentia, ejaculatory ducts and urethra. This urinary and sexual correlation is shown in Fig. 1.

**Minute Anatomy.**—The chief fact is the universal lining of mucous membrane, closely allied in structure from organ to organ. The epithelium varies with function. As in all other mucosæ, those of the urinary and sexual systems are highly vulnerable to infection, have relatively low resistance and recuperation and a distinct tendency to chronic inflammation with temporary or permanent damage shown by epithelial substitution in mild cases and scar tissue replacement in severe cases.

**Definition and General Principles.**—Inflammation of the urethra at any point and due to any cause may properly be described as urethritis. The general clinical features and treatment of urethritis are closely analogous among the usual varieties of the disease. It is therefore well to fix a general conception of the condition and then to distinguish each important kind, especially in the symptoms, diagnosis and treatment.

**Varieties.**—Varieties of urethritis are recognized in accordance with course, extent and cause.

1. *As to onset and course:* acute, subacute and chronic, relapsing, complicated and uncomplicated; also primary as a fresh infection and secondary as a consequence of preceding attacks, or of a systemic disease.

2. *As to location and extension:* anterior, posterior, anteroposterior or general, and localized.

3. *As to cause:* nonbacterial and bacterial. The nonbacterial forms have no microorganisms as conspicuous elements, and include traumatic, diathetic and eruptive urethritis. The bacterial forms always have microorganisms as the primary exciting factors and embrace specific or gonococcal urethritis and nonspecific or non-gonococcal urethritis under which are classed catarrhal, chancrous or syphilitic, chancroidal and herpetic infections of the urethra.

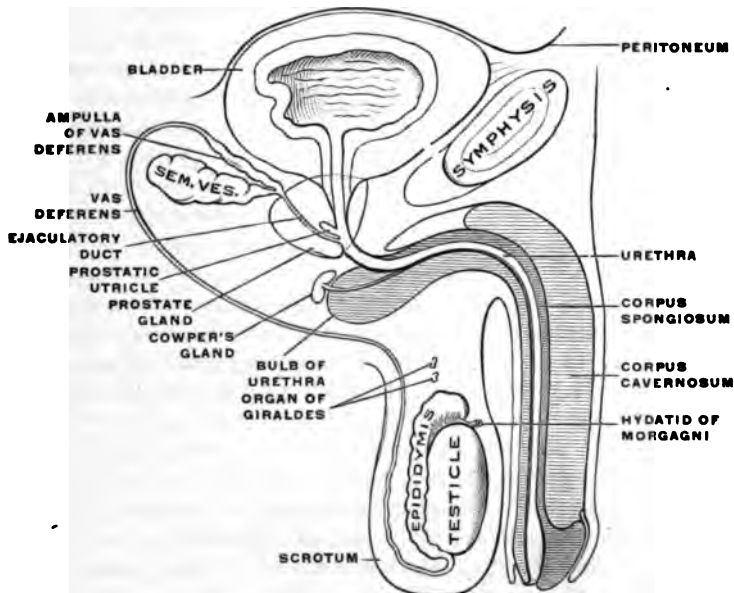


FIG. 1.—Diagrammatic representation of the male organs of reproduction and their relations to the bladder and the urethra. Lateral view. (Toldt.<sup>1</sup>)

For general purposes the most important *clinical classification* is according to course, into acute and chronic urethritis, as all the other varieties may be brought under these two headings. Chronic urethritis is so extensive a subject that it is treated separately in subsequent chapters.

**Location and Extension.**—Location and extension of acute urethritis are, at the onset, at almost any point of the urethra, according to the

<sup>1</sup> Gray's Anatomy, Philadelphia, Lea & Febiger, 1913.

cause, although most urethritis begins at the meatus because sexually infected. Anterior urethritis extends anatomically from the meatus to the triangular ligament, while posterior urethritis passes from the triangular ligament to the cutoff muscle. Both are simply descriptive terms in recognition of anatomical subdivisions. Primary nongonococcal acute urethritis, sexually acquired, follows much the same rule as in chancrous, chancroidal, catarrhal and pyogenic urethritis; but if asexually acquired, it may begin at any point as in the gouty, rheumatic, lithemic and exanthematous types. This variety is, therefore, as a rule, at first either anterior or posterior, extending to involve more and more of the canal.

**Varieties.**—Varieties are clinical according to the kind of infection. Primary anterior gonococcal acute urethritis, sexually acquired, is in the male at first always meatal and in the female likewise, although the vulva, vagina and cervical canal may be attacked at the same time; but if instrumentally acquired, the organisms may be much more widely distributed at the outset. This variety is therefore at first anterior and extends backward, and as a rule an acute posterior gonococcal urethritis may appear, if primary, as a direct extension backward of anterior infection, or, if secondary, as a relapse of persistent chronic infection or as a reinoculation from an old dormant focus.

#### ETIOLOGY IN GENERAL.

The etiology of acute urethritis, in general, is recognized as: (1) specific, having the one definite unvarying cause, the gonococcus; (2) nonspecific, having variable causes, bacterial and nonbacterial, but never the gonococcus. In this work the terms gonococcal and nongonococcal are standard. A bacteriologic differential diagnosis is always essential because the symptoms and courses of both forms are frequently duplicates.

**Nongonococcal Acute Urethritis.**—Nongonococcal acute urethritis is variously systemic or local, predisposing or exciting, intraurethral or extraurethral, bacterial or nonbacterial. Systemic and local are the inclusive subdivisions.

Classification of causes of such a condition as urethritis cannot well be inclusive or exclusive because causes which in some cases are predisposing and systemic may become exciting and local in other cases. The following may be regarded as a general perspective analysis.

The predisposing systemic factors are low vitality, semi-invalidism and acute or chronic alcoholism. Conditions causing hyperacid or hyperalkaline, crystal-laden urine, as in gout, rheumatism, diabetes, lithiasis, tuberculosis and the strumous state, all lead to the so-called diathetic urethritis. Toxemias act in the exanthemata, possibly through bacteria and toxins, and as in eczema through concentration of urine and in herpes progenitalis, chiefly through local irritation, all causing so-called eruptive urethritis. All these elements are usually predisposing, extraurethral and nonbacterial.



Predisposing local factors are a mucosa vulnerable by previous attacks and especially by the presence of the uninfected chronic lesions of gonococcal urethritis such as ulceration, granulations, polypi, fibrosis and stricture, and a mucosa congested and irritable by alcoholism, hyperacidity, alkalinity and sediment in the urine, sexual excess and sexual perversions. These are the predisposing and intraurethral elements.

Periurethral disease, particularly, prostatism in the male, and in the female uterine displacement, postpartum vaginal laceration and deformity may be predisposing extraurethral factors.

Upon the mucosa, as on a soil so prepared any organisms may find ready growth.

The exciting factors in nonbacterial lesions are: (1) traumatism, thermal from too hot or cold irrigations, chemical from too concentrated applications, (2) medicinal from drugs irritant after internal administration such as the balsams, cantharides, alcohol, turpentine, and after eating such vegetables as asparagus, rhubarb, tomatoes, strawberries and the like, and (3) physical from rough instrumentation.

Traumatism may involve any healthy mucosa but is most potent in the unhealthy cases and rests on the use of rough, rusty or ragged instruments as well as unskilled and forceful manipulation. The offense of indwelling catheter is a familiar traumatism and in this class belong masturbation and sexual excitement without coitus. Caution should always be exercised to pass smooth instruments and with gentleness, never to use applications of extremes of temperature or concentration, and never to repeat treatment at intervals too short for a recovery period.

Exciting factors in bacterial urethritis are *Micrococcus catarrhalis* in true catarrhal forms, *Treponema pallidum* in syphilitic types, the *Bacillus of Ducrey* in chancroidal invasions, and the ordinary *pyogenic organisms* in simple pus cases. *Bacillus coli communis* is often seen. Bacteria are doubtless a factor in the majority of cases, hence the importance of bacterial investigation.

**Catarrhal Acute Urethritis.**—Catarrhal acute urethritis is caused by the *Micrococcus catarrhalis* which, in morphology, is the duplicate of the gonococcus. It is at first gram-positive, later gram-negative, chiefly extracellular, frequently intracellular, and cannot be distinguished from the gonococcus in these circumstances except by culture.

**Syphilitic Acute Urethritis.**—Syphilitic acute urethritis is chancrous and usually meatal or just posterior to it, marked with edema and infiltration even to stricture and stenosis, with seropurulent or serosanguineous discharge present only in the first glass of urine, and as a rule without any shred stage. Its resolution is slow without intensive antisyphilitic treatment. Occasionally subpreputial chancres and mucous patches may cause involvement of the meatus. The organism is the *Treponema pallidum*.

**Chancroidal Acute Urethritis.**—Chancroidal acute urethritis is much the same as syphilitic urethritis in its location and effects. The organism is the *Bacillus of Ducrey*.

**Etiology of Gonococcal Acute Urethritis.**—Gonococcal acute urethritis has invariably the *gonococcus* discovered by Neisser<sup>1</sup> in 1879 and cultivated by Bumm<sup>2</sup> in 1885. This organism commonly exists in pure culture, in most cases of urethritis, but is often found associated with other organisms.

### BACTERIOLOGY IN GENERAL.

**Normal Flora of the Urethra and Prepuce.**—Before comprehension of the bacteriology of acute urethritis is possible, one must remember that these regions, like every other part of the body, are normally the habitat of various organisms whose exact influence on the physiology of the part is not absolutely understood. They doubtless serve a

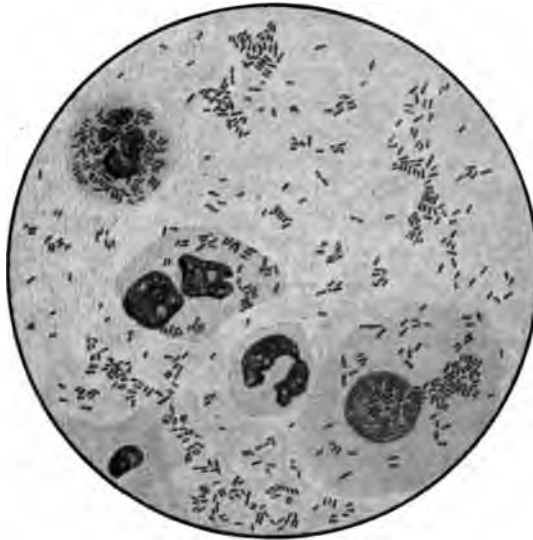


FIG. 2.—Nongonococcal urethritis. Smear from the urethra of a case of nongonococcal urethritis due to pseudodiphtheria bacilli (800 diameters). (After Lipschütz.<sup>3</sup>)

beneficent purpose, otherwise they would hardly exist there. Their importance arises from the fact that many of them are capable of vicious change upon the advent of pyogenic and gonococcal infection whose activities excite them and are in turn themselves frequently augmented. Familiarity with the general flora of these parts of the body in both sexes cannot be neglected. The following illustration indicates organisms in an ordinary specimen.

**Nongonococcal Acute Urethritis.**—Nonbacterial Nongonococcal Acute Urethritis.—In all subjects, the urethra, prepuce, vulva and vagina

<sup>1</sup> Centralbl. f. d. med. Wissenschaft., 1879, xvii, 497.

<sup>2</sup> Der Mikro-organismen der gonorrhoeischen Schleimhaut-Erkrankungen, "Gonococcus Neisser," Wiesbaden, 1885.

<sup>3</sup> Bacteriologischen Grundriss und Atlas der Geschlechtskrankheiten, 1913.

are normally, in health, the habitat of various bacteria, as already stated. These are innocuous and attenuated through long residence and purposeful in unknown degree, but they may become nocuous and hyperactive under excitation from other sources. Thus nonbacterial nongonococcal acute urethritis of traumatic, diathetic or eruptive origin may be converted into the bacterial type.

**Bacterial Nongonococcal Acute Urethritis.**—The organisms which cause bacterial nongonococcal acute urethritis are *streptococci*, *staphylococci*, *pseudodiphtheria bacilli* and *Bacillus coli communis* in the pyogenic lesions, *Micrococcus catarrhalis* in the true catarrhal inflammations, *Treponema pallidum* in syphilitic and *Bacillus of Ducrey* in chancroidal, and various organisms in herpetic urethritis. Luys<sup>1</sup> on this subject says that the most important are the *streptococcus*, *staphylococcus*, *pneumococcus*, *Micrococcus fullax*, *Micrococcus pyogenes aureus*, *Micrococcus cereus albus*, *Bacillus typhosus*, *Bacillus coli communis*, *Bacillus diphtheriae*, *Bacillus tuberculosis* and various sarcinae. A small, thin bacillus in chains and clumps is, according to Finger,<sup>2</sup> referred to by Luys,<sup>3</sup> the common saprophyte of the prepuce and very often in the urethra in long-standing cases. Moscato<sup>4</sup> reports a case of urethritis accompanying every attack of intermittent fever.

**Catarrhal Acute Urethritis.**—Acute catarrh of the urethra is caused by the *Micrococcus catarrhalis* and merits special consideration in all its clinical aspects.

The history of the *Micrococcus catarrhalis* is of interest. For years skilled urologists have been convinced that there is a diplococcus other than the gonococcus of Neisser capable of exciting acute inflammation in the sexual and urinary passages of both sexes. The general nature of such inflammation is much like that of true gonococcal invasion, but the symptoms are less severe, the course less protracted and uncertain, the complications relatively unknown and the termination in absolute recovery almost universal. W. Ayres<sup>5</sup> has published the best brief review on this subject and quotes in substantiation of his observations such authors as Watson and Cunningham,<sup>6</sup> E. L. Keyes,<sup>7</sup> Mallory and Wright,<sup>8</sup> Wood,<sup>9</sup> Hiss and Zinsser,<sup>10</sup> Ghon, H. Pfeiffer and Sederl,<sup>11</sup> Frosche<sup>12</sup> and Kolle, Libman and Celler<sup>13</sup> and Park and Williams.<sup>14</sup>

<sup>1</sup> Text-book on Gonorrhea, 1913, pp. 41 and 42.

<sup>2</sup> Discussion of Gross's paper, Arch. f. Derm. u. Syph., 1905, lxxv, 39. Adrian (reference to Finger): Die Nichtgonorrhoeische Urethritis, Halle a. S., 1905, p. 58.

<sup>3</sup> Loc. cit.

<sup>4</sup> Il Morgagni, 1890, xxxii, Parte I a, 627, 687-8.

<sup>5</sup> Am. Jour. Surg., March, 1912.

<sup>6</sup> Genito-urinary Diseases.

<sup>7</sup> Diseases of the Genito-urinary Organs.

<sup>8</sup> Pathological Technic.

<sup>9</sup> Chemical and Microscopic Diagnosis.

<sup>10</sup> A Text-book of Bacteriology.

<sup>11</sup> Ztschr. f. klin. Med., 1902, xlv, 262.

<sup>12</sup> Flügge, Die Mikroorganismen, 1896, 3d ed., B. ii, p. 154. These men describe the coccus and state that R. Pfeiffer terms it kokkus catarrhalis. What R. Pfeiffer states of its properties is derived from oral statement. Hence, R. Pfeiffer in Frosche and Kolle.

<sup>13</sup> Reports of Mt. Sinai Hospital, 1903.

<sup>14</sup> Pathogenic Bacteria and Protozoa.

The morphology of the *Micrococcus catarrhalis* as described by Libman and Celler,<sup>1</sup> quoted by Ayres, is as follows: “. . . Almost identical morphologically with the meningococcus, but differing from it culturally, is an organism found in normal and in some pathological conditions on mucous membranes of the respiratory tract, in the eye, the ear and occasionally in the urethra. This is the *Micrococcus catarrhalis* of Pfeiffer.

“In spreads this organism appears also as a diplococcus, with some flattening of the adjacent sides of the individual cocci. It decolorizes with Gram's solution. There is no capsule. In all its characteristics it bears so close a resemblance to the gonococcus that it can be differentiated therefrom under the microscope only with great difficulty.

“*Points of Difference.*—The tetrads formed by the meningococcus, as well as the large forms already mentioned, will sometimes, however, serve to differentiate this from the other two organisms. Further, the individuals of the *Micrococcus catarrhalis* are more nearly oval than those of either the gonococcus or meningococcus.

“On agar the *Micrococcus catarrhalis* grows profusely—herein differing from both the meningococcus and the gonococcus—they show no growth or slight on this medium.”

The *Micrococcus catarrhalis* in its effects is relatively a less vicious organism than the gonococcus but potentially it is capable of exciting all the symptoms of gonococcal invasion. The symptoms of gonococcal disease are fully described on pages 33 to 36. On this general subject Ayres draws the following conclusions, in the contribution already cited: “(1) Demonstration of a gram-negative diplococcus within the pus cells of a discharge from the urethra is not proof positive of a gonococcic infection. (2) The fact that a man has an urethritis which shows gram-negative diplococci is not proof positive of recent exposure to gonorrhea by copulation. (3) Not only is a microscopic examination necessary in all cases of urethritis, but in a certain proportion a culture is imperative. (4) All cases of urethritis beginning as a subacute inflammation should be regarded with suspicion. (5) Just because an urethritis is very mild at the start, it should not be classed as a *Micrococcus catarrhalis* infection until it has been proven so by culture—gonorrhea is too serious a disease to be excluded without thorough investigation. (6) The *Micrococcus catarrhalis* is not a germ of slight pathogenicity, but is capable of causing serious and even dangerous inflammation.”

**Urethritis Due to Pfeiffer's<sup>2</sup> Streptobacillus.**—A peculiar form of non-gonococcal urethritis has been described by Pfeiffer. Its characters are typified by the following three brief case reports. The lesion as shown in the first case is practically autogenous. The second case features the appearance of the inflammation long after the true gonococcal urethritis has ceased, and the third case shows its incidence very soon after the gonococcal infection. I. The man had obstinate

<sup>1</sup> Loc. cit.

<sup>2</sup> Pfeiffer, Engwes: München. med. Wchnschr., 1916, lxiii, 1457.

acute gonorrhea posterior; it was nine weeks before a prostatic focus was removed. The urethra was now sterile and all treatment was suspended. On the seventh day appeared spontaneously a mucopurulent discharge. Smears showed pure culture of the streptobacillus. Same also cultivated pure from secretions. Conditions persisted for nine days and suddenly ceased. Diagnosis, streptobacillary urethritis in a urethra damaged by gonorrhea. Characteristic is the presence of very many bacilli in the pus corpuscles which often appear quite dark in consequence.

II. Man with alleged second attack of gonorrhea which had persisted for six weeks. First attack ten years before; whitish discharge. Urethra and prostate seemed normal. The secretion contained a pure culture of Pfeiffer's germ for three weeks. No gonococci at any time. No treatment until urine in second test glass was clear. Weak sublimate injections given for four weeks when urine became quite sterile.

III. First attack of gonorrhea. Gonococci in urine for five weeks. Urine then became sterile but discharge reappeared just as he was about to be released. Pfeiffer's bacillus present alone for ten days, then associated with gonococci from an overlooked prostatic focus.

**Gonococcal Acute Urethritis.**—Gonococcal acute urethritis is confined solely to the *gonococcus*, also known as *Micrococcus blennorrhæa*, *Neisseria gonorrhæa*, *Micrococcus gonorrhæa* or *Diplococcus gonorrhæa*.

**Gonococcus.**—This organism is so essential to the purpose of this work that its bacteriology will be discussed under the headings of natural and morphological characters, details of Gram's stain, cultural characters and culture on humanized and animalized media. Other gram-negative cocci will then be considered.

**Natural Characters.**—The gonococcus is a parasite. Its vitality outside the body is little and on the skin surface it will not produce lesions, but inside the body, in its normal habitat in the mucous and serous membranes, it will live for many years, often attenuated and harmless until excited by an outside cause precisely as in nongonococcal acute urethritis. Its virulence is well known and fully established and rapidly revives in virgin soil, that is to say—an infection without symptoms in man or woman transplanted to an uninfected member of the opposite sex will invariably revive in all its violence.

Its habitat is the mucous and serous membranes primarily in the epithelial and endothelial layers and secondarily, by and after penetration, in the underlying structures, especially the subepithelial and subserous layers, and even the submucous tissue. By direct continuity of the mucous surface it will infect in the male the prepuce, urethra, Cowper's glands, prostate, vasa deferentia, seminal vesicles, epididymis and testis, and, in equal degree, in the female vulva, urethra, vagina, cervix, uterine lining, tubes and ovaries and peritoneum. Its destructive activity may render either sex sterile and practically unsexed. By absorption into the system it will reach the serous linings of the joints, pleura and endocardium, not infrequently in association with

other organisms. Septicemia from its constitutional activity is not uncommon. Immunity against it after an attack is *nil* both against a reinfection from a new host and against a relapse from excitation of an old focus within the same patient. In this it differs from very many other infections and is correspondingly more difficult to control. Similarly it does not lend itself to study through animal experimentation as its general characteristics change in the process. At least twelve different types of various virulence and potency have been isolated.

*Morphological Characters.*—This organism is, in form, coffee-bean shape with the flat surface slightly concave, in grouping, pairs or fours with a distinct interval between the individual cocci, in multiplication, nonspore-bearing splitting taking place in one plane into the diplococcus, or very exceptionally, in two planes into the tetrad type, in position, intracellular within the protoplasm of pus and epithelial cells or extracellular within the general exudate, in staining, susceptible to the basic aniline dyes such as methylene blue, Bismarck brown and gentian violet, in microchemistry gram-negative, that is to say—it gives up the basic dye under the influence of Gram's iodine solution as a mordant and alcohol as a decolorizer.

*Details of Gram's Stain.*—1. With precautions against contamination by washing the glans in the male and the vulva in the female for meatal or urethral specimens and by retracting the vulva and dilating the vagina in the female for access to the vagina and uterus and the labia according to the point from which the pus is sought, and by following every other detail for securing a proper specimen, spread a smear *thinly* upon a slide.

2. Dry in the air and fix with gentle heat or with equal parts of ether and 95 per cent. alcohol. Drain.

3. Stain two minutes with any 1 per cent. carbolic basic dye such as methylene blue or gentian violet.

4. Drain and absorb excess of dye with filter paper, gently applied as a blotter to ink.

5. Flood for two minutes with Gram's iodine solution, but do not use water after step No. 4, as water precipitates the iodine and hinders its action.

6. Wash for about two minutes with 95 per cent. alcohol until all color to the naked eye is lost.

7. Wash with water, drain and dry with filter paper.

8. Stain for about one minute with any contrast stain, such as Bismarck brown.

9. Wash with water, drain and dry thoroughly as before, and examine with a one-twelfth oil-immersion lens.

The gonococci being gram-negative and having surrendered their original color will be stained brown or the color of any other counterstain used, but the rest of the specimen will have the color of the original dye employed. No organism should be regarded as possibly the gonococcus which does not possess these staining qualities, but the *Micrococcus catarrhalis* is, in its early life-cycle, gram-positive and in its later development gram-negative. Culture alone will distinguish



*Cultural Characters.*—Cultural characters are peculiar in that the organism is very difficult indeed to grow artificially. Attenuated specimens from cases of long standing are said not to grow at all artificially and yet when implanted on virgin, that is, previously uninfected soil in the mucous surfaces of either male or female sexual organs, they will rapidly acquire their typical virulence. This is one of the facts which makes the decision of final cure so difficult to make absolute. Human blood serum seems to be the best medium for the culture and the organisms must not be chilled in any way but must be transferred from the host to the medium itself at body temperature and at once put into the incubator. Thus, either the patient should be sent to a fully equipped laboratory for these steps, or the physician himself must have a suitable incubator for protecting the inoculation until transferred to the laboratory, again fully protected. The sources of culture are the same as for slide specimens, namely, free pus, shreds and urinary sediment after centrifuging. Of course, every possible precaution against contamination must be exercised and several days allowed for the growth to appear, which is invariably slow.

Culture of the gonococcus is delicate and difficult, best on humanized media and least successful on animalized media. Solid slant medium in a test-tube seems much more advantageous than fluid medium. Humanized preparations have the following formulas: Wertheim<sup>1</sup> uses a solid media human serum from hydrocele ascites or blood, mixed with meat infusion agar two or three parts and glycerine 6 per cent. or glucose 1 per cent. Fluid media contain human blood serum mixed with meat infusion peptone broth having peptone up to 2 per cent. A drop of human blood also may be smeared over a plate as in Pfeiffer's method for the bacillus of influenza. Animalized media are agar mixed with natural rabbit's blood or Wassermann's serum-nutrose of swine.

Surface inoculations show the organism to be aërobic; stab inoculations into solid media fail as the organism is not anaërobic and inoculations into fluid media are followed by growths only at the surface for the same reason. The temperature of growth is 37.5° C., death ensuing at 38.5° C. and at 30° C. Colonies of the gonococcus are thin gray or opalescent spots looking much like varnish dropped on the medium slightly "bloomed." Growth should appear in about twenty-four hours. Merging of the colonies does not occur and stickiness of the growths is a diagnostic feature.

**Other gram-negative cocci** when compared with the gonococcus in urethral infections become exceedingly important and their differential features in the laboratory are shown by the following table. It becomes extremely important for the urologist to know the cocci in this group which includes the *Micrococcus catarrhalis*, *Micrococcus intracellularis*, *Micrococcus gonorrhææ*, clear micrococcus and opaque micrococcus, both from Hartford's case of influenza-like epidemic, micrococcus from the urethra, *Micrococcus melitensis* and Malta fever. Their characteristics should be similarly familiar.

<sup>1</sup> Arch. f. Gynäk., 1892.

CHIEF CHARACTERISTICS OF SIX GRAM-NEGATIVE COCCI.<sup>1</sup>

Organism and source.	Growth on nutritive acetie agar at 37° C.	Growth on gelatin at 20° C.	Pathogenicity.	Action of carbohydrates.			
				Glucose.	Galactose.	Maltose.	Saccharose.
<i>M. catarrhalis</i> nasal and pharyngeal discharge.	Opaque; granular.	Positive (grows on ordinary agar at 37° C.	Mice and guinea-pigs by intraperitoneal inoculations.	-	-	-	-
<i>M. intracellularis</i> (meningococcus), cerebrospinal meningitis.	Clear, smooth.	Negative.	In some cases mice and guinea-pigs by intraperitoneal inoculations.	+	+	+	-
<i>M. gonorrhoeae</i> (gonococcus), urethral discharge.	No growth unless blood added.	Negative.	In some cases mice and guinea-pigs by intraperitoneal inoculations.	+	+	○	○
From nasal discharge from Hartford's case of influenza-like epidemic.	Clear, smooth and becomes yellowish.	Negative at first, later positive (grows on ordinary agar at 37° C.	Mice and guinea-pigs by intraperitoneal inoculations.	+	-	+	-
From nasal discharge from Hartford's case of influenza-like epidemic.	Opaque, granular.	Negative.	Mice and guinea-pigs by intraperitoneal inoculations.	+	+	+	+
From urethra.	Opaque; somewhat granular, smooth edges.	Negative.	Mice and guinea-pigs by intraperitoneal inoculations.	+	+	+	+
<i>M. melitensis</i> ; Malta fever.	Creamy and slightly yellowish.	Positive.	Monkeys, also rabbits and guinea-pigs, by intracerebral inoculation.	-	○	○	○

## PATHOLOGY IN GENERAL.

**General considerations** must include the fact that mucous membrane has comparatively little recovery power from the effects of a single severe attack, repeated invasions or a prolonged involvement. The surface epithelium is denuded readily and when restored may lack the original characters, being changed from columnar to squamous. The glands furnishing moisture to the membrane and the cavity of the urethra are readily changed so that their secretion instead of being thin and almost invisible becomes thick, tenacious and yellow, often mixed with pus cells and desquamated epithelium. Many glands lose their power of secretion and surrounding glands take up overactivity in compensation and the condition becomes chronic. Similarly round-cell and fibrous infiltration often replace the mucous membrane in its essence, and the condition remains chronic in character. Restitution of chronic lesions is never fully made, no matter what their nature is, and the various stages leading up to the permanent lesions are also very difficult to control or change.

**Nongonococcal Acute Urethritis.**—Nongonococcal acute urethritis varies in pathological details with the forms previously enumerated,

<sup>1</sup> Dunn and Gordon: *British Med. Jour.*, 1905, ii, 427.

namely—catarrhal, eruptive, diathetic, pyogenic, syphilitic, chancreoid and herpetic. Each has its own pathology.

**Catarrhal Acute Urethritis** is in essence a local or general hyperemia, with edema and occasionally slight hemorrhage. It has stages of onset, establishment and subsidence each in itself and all combined, as a rule, rather brief except with persistence of the exciting cause. It may be anterior, posterior or anteroposterior in distribution. Its exudate is mucus or serum in the mild cases, mixed with pus in the severe cases, each type having a progressing degree of desquamation of epithelium. Its involvement includes the epithelium and the glands of the mucosa and rarely the submucosa, in lesions which are temporary, and rarely with associated complicating or permanent factors. The lesions are located in the mucous membrane alone and distributed locally—anteriorly, posteriorly, or anteroposteriorly. The gross and microscopic features are those standard for catarrhal exudative inflammation. Bacteria may be practically absent or comprise chiefly the *Micrococcus catarrhalis*. Toxins, therefore, do not play an important role.

**Diathetic and Eruptive Acute Urethritis.**—Diathetic and eruptive acute urethritis duplicate that of catarrhal forms adding the special urinary findings of the diathetic and the associated lesions, especially in the eruptive diseases, such as eczema, the exanthemata and the like.

**Pyogenic Acute Urethritis.**—Pyogenic acute urethritis is that of a purulent mucous membrane inflammation, local or general in distribution. Its essence is infection with the pyogenic organisms.

Its stages are those of infection—early and brief catarrhal inflammation, rapidly followed by purulent manifestations and extension from its early local site with finally slow recovery. Each stage in itself and all combined are prolonged and may leave behind a mucous membrane damaged as much as may gonococcal infection. Its exudate is finally pus in all cases with blood, mucus and epithelium—all in quantity varying with the severity. Its involvement includes the epithelium and the glands of the mucosa at first, then the submucosa and even the underlying tissues of complicated cases. The lesions are temporary only in the very mild cases but severe forms by the extension of the infection leave permanent sequels in the mucosa and complicating results in surrounding organs. The gross and microscopical features are those typical of suppurative mucosal inflammation, commonly located in the mucous membrane alone in all its layers and distributed locally or throughout the urethra. Bacteria are always present, especially *Bacillus coli communis*, *Streptococcus pyogenes* and *Staphylococcus pyogenes*, whose toxins excepting in the complicating cases appear to have little effect systemically on the disease.

**Syphilitic Acute Urethritis.**—Syphilitic acute urethritis is the pathology of chancre, meatal or intrameatal in its location. Its essence is invasion by the *Treponema pallidum* with the small, round-cell infiltration in the effort of nature to combat the process. Its stages are those of nodulation, superficial or deep ulceration and slow healing. Each period is in itself and all combined are rather prolonged and leave

behind a scar-like mass which rarely fully disappears. Its exudate is serum, not autoinoculable, in all cases mixed with blood during deep ulceration and with pus if an associated organism is present. Its involvement includes the mucosa in all its layers and the submucosa, so that more or less obstruction of the canal results. Its gross features are those of pure or mixed infection in an ulcer having a definitely, though variably, infiltrated base, and its microscopical features are those of small round-cell and fibrous infiltration in the base and necrosis in the ulcer. The organism is the *Treponema pallidum* alone or associated with various pyogenic organisms. The organism of syphilis, its circulation through the system and its toxins with their effects are foreign to the purpose of this work or further discussion concerning temporary complicating and permanent lesions.



FIG. 3.—*Treponema pallidum* from a chancre. The figure reveals a dark field illuminator picture with the organisms moving across it. (After Lipschütz.<sup>1</sup>)

Occasionally mucous patches in the second stage or in the uncleanly in any stage of syphilis may appear in crops under the prepuce and one or more of them locate in the meatus in the male or similarly in the female about the vestibule and meatus. They then behave in pathology much as the chancre in causing acute urethritis.

The presence of the *Spirocheta balanitidis* in the normal and inflamed prepuce renders its distinction from the *Treponema pallidum* necessary at times by culture. The following illustration typifies the general characters of the treponema after the recognized method of the dark field illumination and merits study.

<sup>1</sup> Loc. cit.

**Chancroidal Acute Urethritis.**—The pathology of chancroidal acute urethritis is that of chancroid, meatal or intrameatal in location. Its essence is infection with the *Bacillus of Ducrey* with necrotic ulceration. Its stages are those of early ulceration, circumscribed cellulitis, slow healing at some points with extension at others and final healing with excavated scar. Its exudate is autoinoculable pus mixed with blood and detritus. Its involvement includes the mucosa in all its layers and the underlying structures so that deformity of the canal or, less frequently, stenosis is produced by the scar. Its gross features are those of pure or mixed infection in an ulcer with an excavated, undermined, sloughing base, and its microscopical features are those of infiltration,

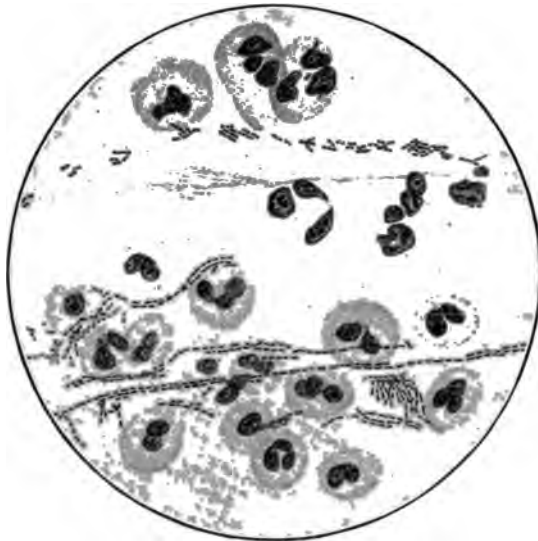


FIG. 4.—Chancroid or venereal ulcer. Smear from the secretion of the depths of a soft sore (800 diameters). (After Lipschütz<sup>1</sup>).

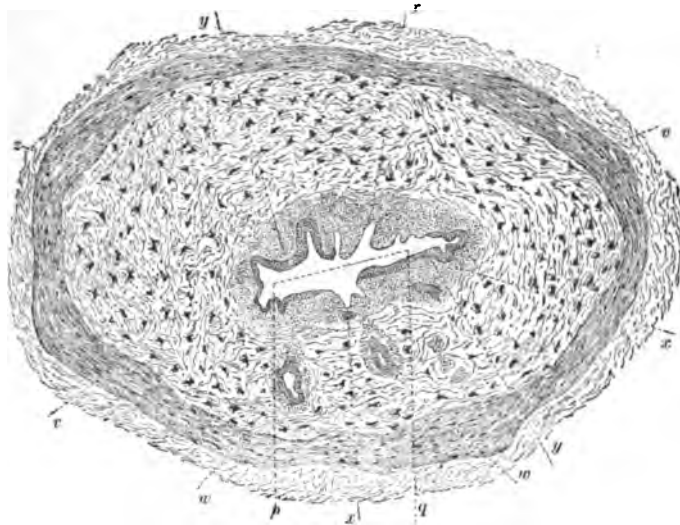
edema, necrosis and fibrous healing. The organism is the *Bacillus of Ducrey*, often mixed with pus-producing germs. The chancroid itself is usually a temporary lesion but may show rapid and widespread phagedenic qualities. The permanent lesion is the scar after healing and lymphangitis and inguinal adenitis are frequent associated lesions. Further discussion is unnecessary for the purposes of this work.

**Herpetic Acute Urethritis.**—The pathology of herpetic acute urethritis includes the features of the herpetic vesicles situated at or within the meatus. Its essence and stages are the formation of infiltrated papules which soon show a little vesicle on their summit filled at first with serum, then with pus, spontaneously bursting and leaving a superficial ulcer unless invasion with pyogenic organisms now occurs. Its exudate is at first serous, then purulent, and its involvement hardly more than the

<sup>1</sup> Loc. cit.

# PLATE I

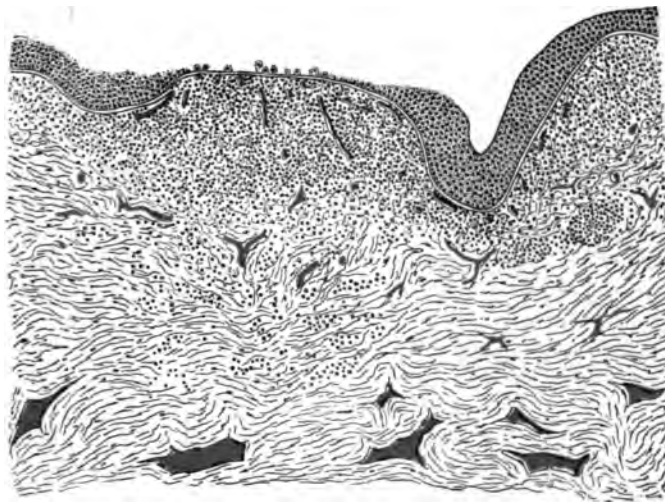
FIG. 1



Transverse Section through Entire Urethra and Tunica Albuginea with Round-cell Infiltration of the Urethra and Mucous Follicles. (After Taylor.<sup>1</sup>)

The whole folded lumen of the urethra is surrounded by a deep ring of small round cells (z), which seem mainly to have come from the superficial vessels of the mucosa, while a part of them may be proliferated connective-tissue cells. The epithelial lining of the urethra is desquamated, and is entirely absent in places (x, r, r), while in other places (y, y) it is still in proper position, although infiltrated with pus cells. In the roof of the urethra, in this section, the ducts of the mucous glands at various depths are also surrounded by a heavy infiltration of small round cells which indicate an extension of the inflammation along the mouths of the glands from the surface of the urethra (w, w).

FIG. 2



Ulcer of the Urethra with Round-cell Infiltration of Floor and Erosion of Epithelium of its Surface. Newly Formed Capillaries are in Red. (After Taylor.<sup>1</sup>)

<sup>1</sup> *Genito-urinary and Venereal Diseases*, 3d Ed., 1914



epithelial layer with a little firm edema beneath. Its gross features are those of a superficial sore with reddened base, or a small vesicle or pustule on such a base according to stage, and its microscopic features are those of epithelium detached into the vesicle or pustule

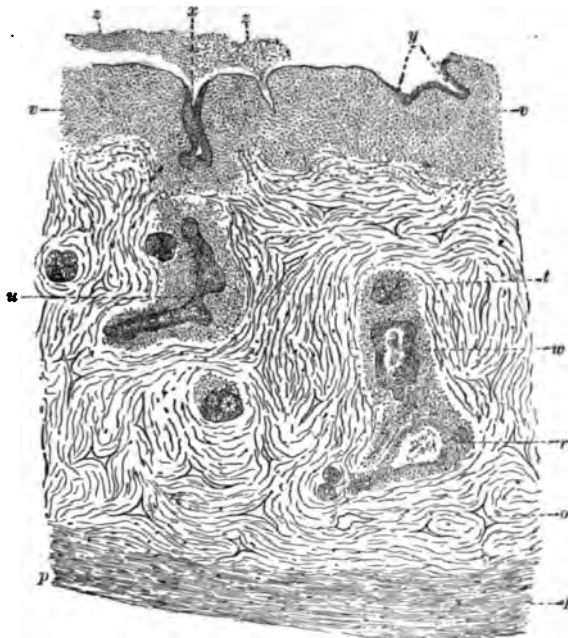


FIG. 5.—Section of urethral roof with round-cell infiltration of mucosa and follicles, more highly magnified than the Fig. 1 in Plate I. "Fig. 5 shows the invasion of the urethra by the gonorrheal process still more plainly. The drawing includes the whole thickness of a segment from the roof of the urethra, corresponding to the rectangular area indicated by *p, q*, in Plate I, Fig. 1. With this higher magnifying power in Fig. 5, the infiltration of the mucosa and tissue surrounding the tubular ducts of the mucous glands is shown in detail. With the exception of the patches denoted by *x* and *y*, the epithelial lining of the urethra is absent, so that there are extensive areas of erosion of the infiltrated mucosa. Lying free in the urethral lumen near the denuded surface is a flake of the gonorrheal exudation (*z, z*, Fig. 5). This flake is quite identical in structure with the ordinary gonorrheal discharge as seen on a cover glass, and consists mainly of pus cells lying in a fluid or granular matrix. The mucosa just beneath what is left of the epithelial lining is very densely crowded with small round cells to the extent shown in the figure at *v, v*. In the same way the ducts of the mucous glands *u, w*, and *r*, and in places the gland acini themselves (*t*) are similarly infiltrated with the small round cells. The ducts *w* and *r* have their lumina partially filled with desquamated cells and granular material." (Taylor.<sup>1</sup>)

and the surrounding edema and infiltration. No definite organism has been isolated and the lesions are temporary without permanent or associated elements, scarring occurring only after mixed infection.

**Gonococcal Acute Urethritis.**—Gonococcal acute urethritis is a superficial or penetrating suppurative inflammation of the mucosa according to

<sup>1</sup> Genito-urinary and Venereal Diseases, Philadelphia, Lea & Febiger, 1904.



intensity. Primary cases comprise the first attack and secondary cases are subsequent fresh reinfections of cured cases or sequels of uncured cases or relapses of the latter without the element of reinfection. Its essence is infection by the gonococcus and its stages are incubation of catarrhal type, early establishment of desquamative character and full invasion or acme of suppurative features with death of epithelium and leukocytes. Its exudate is autoinoculable and heteroinoculable pus containing epithelium, white cells, red cells (all degenerated into pus cells) and myriads of gonococci—all mixed in a fluid basis of serum and mucus. In distribution it regularly begins at the meatus in the male, if sexually acquired, and in the female at almost any point but usually the urethra and vulva are early involved or the vault of the vagina and cervix through intimate contact with the infecting ejaculation. Relapsing cases begin at any focus and progress therefrom. Extension follows rapidly in continuity of surface so that in the male the lining of the foreskin and the urethra from end to end suffer, making the so-called anterior, posterior and anteroposterior cases, and so that in the female the external genitals, urethra, vagina, endometrium, oviducts and peritoneum may become involved. The lesions are deepest where oldest with rare exceptions. The gross features of the disease are in regular sequence catarrh with edema, followed by more or less hemorrhagic suppuration. The microscopic features are hyperemia, denudation, hemorrhage, pus-cell and tissue-cell infiltration, with gonococci in the pus cells, epithelial cells and free in the pus and tissues. All these features are found in the mucosa in various and every layer and in the periurethral structures in severe cases and in surrounding organs in complicated cases. Penetration into the depths of the mucosa precedes and accompanies extension along the surface. The first thirty-six hours are concerned with the incubation, during which the superficial cells are passed and the subepithelial connective tissues reached. The second thirty-six hours reach the stage of invasion with early exudate and are characterized by desquamation, pus-formation, diapedesis of leukocytes, capillary congestion, arteritis, phlebitis and lymphatic and glandular involvement. Termination is marked by the subsidence of active hyperemia, decrease and finally disappearance of gonococci and repair of the damaged mucous membrane, if recovery is complete; but if incomplete the disease may be protracted at almost any focus and in any degree, thus constituting gonococcal chronic urethritis.

The pathological varieties are therefore acute, subacute and chronic, primary and secondary, uncomplicated and complicated.

Nature's combat against the disease is shown in the hyperemia, in the diapedesis and phagocytosis of the leukocytes and in the serum of lymphatic activity and shown in the exudate by the casting off of dead and dying epithelial and white bloodcells and the fluid elements of the pus, all containing the gonococci, and shown in the repair process of tissue proliferation to restore the loss and again shown in the resistance of the serum to the disease for the destruction of the organism and the neutralization of the toxins. The systemic effects of gonococcal acute

urethritis, unless pyogenic organisms are associated, is relatively little when compared with those of other infections. This pathological fact accounts for the peculiarity that in the treatment antigonococcal serum and bacterin are distinctly likewise of less value. There is, however, a complement deviation test, also called complement fixation test, perfected by Schwartz,<sup>1</sup> similar to the Wassermann complement fixation test in syphilis in its general nature and interpretation of the disease. Pathologically, therefore, a positive test denotes presence of the disease while a negative may mean its absence whose definiteness and permanence, however, are as yet less understood than those of positive reactions and can be interpreted only after years of further observation.

The temporary lesions of gonococcal acute urethritis occur only in mild cases or in areas of mucosa least involved. In severe cases, its permanent lesions are almost inevitable and comprise destruction of the mucosa and its glands in varying degree along with similar processes in an organ secondarily attacked in complicated cases and result in the lesions of chronic urethritis which must be discussed as a separate subject (see page 263). Its complicating lesions when localized in the sexual organs of both sexes involve the mucous glands and follicles, periurethral tissues and lymphatics extending in the male to Cowper's glands, the prostate, vasa deferentia and testicles, and in the female to the vulvovaginal glands, vagina, endometrium, tubes, ovaries and peritoneum, and when reaching the urinary organs in both sexes involve the bladder, ureters, and kidneys. The process is in every pathologic feature the same in glands or organs secondarily and complicatingly attacked as in the urethra itself in primary uncomplicated acute urethritis. Its lesions of absorption or penetration of the organisms involve serous membranes other than the peritoneum, notably endocardium, pleuræ and joints. Death from gonorrhea is by no means unknown, although rare, as a process of general septicemia. Lesions predominate in any part of the canal and constitute in this manner anterior, posterior and anteroposterior urethritis, each having its appropriate symptoms under the same titles as described hereinafter.

**Gonococcal Chronic Urethritis.**—Pathology of gonococcal chronic urethritis, on account of its many important clinical factors, is treated as a separate subject in Chapter IV, page 265.

### SYMPTOMATOLOGY AND STAGES.

**Point of Onset.**—The disease regularly begins at the meatus in both sexes in sexually acquired primary cases and in the female also at the vulva, vault of the vagina or cervix in accordance with the various points of inoculation. It is, therefore, at first always anterior in the urethra. Secondary or relapsing acute disease may begin at any point of the urogenital tract in either sex from a focus of chronic infection;

<sup>1</sup> Schwartz, H. T., and McNeil, A.: *Am. Jour. Med. Sc.*, 1911, xci, 693.

thus in the male the posterior urethra or the surrounding organs and in the female the internal sexual organs may first light up in a relapsing attack before the distal parts are engaged secondarily to it.

The chief local symptoms are much alike in both primary and secondary cases, namely—discomfort, pain, pollakiuria, hemorrhage, exudate and chordée. The following general facts of each symptom are noted:

**General Clinical Features.**—All the usual symptoms of inflammation of any mucous membrane are present, varying in character and degree with the attack itself. All elements which excite simple catarrhal urethritis tend to arouse and augment all other forms. The symptoms are subjective, objective and systemic, concerned with the system at large and local, involved with the urogenital system in particular. In the affected organs pathological processes in the mucous membrane give certain clinical features and functional derangement causes still other signs.

**Subjective Symptoms.**—The subjective symptoms are greatest when the deeper layers of the mucosa are exposed and the tissues infiltrated and hemorrhagic. Extension into complications always means increased as well as new symptoms and often the advent of subjective symptoms if previously absent.

**Objective Symptoms.**—The objective symptoms are concerned in the immediate lesions and results in the mucosa itself, the discharge and the bacteriology in all cases, to which is added the symptoms of complications when they arise.

**Systemic Symptoms.**—The systemic symptoms are those of infection, occurring only in severe cases, chills, fever, malaise, prostration, anorexia and the like. Complications are also apt to be associated with these signs.

**Local Symptoms.**—The local symptoms should be described in detail and are comprised in discharge, urinary disorders, functional derangement in all cases and numerous complications, often simple, but in many cases severe.

Discomfort and sense of heat are rarely present during incubation but appear with the hyperemia of the invasion and its early serous discharge, which gravitating to the floor of the urethra is felt there. Vulvar and vaginal infections closely imitate these conditions. Pain of distinct and progressing irritating character marks the extension of the disease along the passage and into the depth of the mucosa. Its sources are denudation, pressure of infiltration and distention of edema in both sexes and in any membrane attacked. Bacterial growth and toxins are also sources of pain.

Pollakiuria is due to reflex disturbance in the urethra in the anterior canal of the male and in the whole passage of the female, by all the pathologic activities, and due to direct irritation of the sphincter vesicæ in the posterior urethra in the male. The hyperemia is the early and the exudate the later factor. In the female this symptom is rather independent of vulvar and vaginal involvement, and again it is related

to the cutoff muscle. Hemorrhage, in streaks through the exudate or in drops with the terminal urine, is a rare symptom except in severe cases, while free terminal bleeding is not unknown. Intense congestion and minute tears through chordée are the common causes. Blood as a factor under the microscope is often seen. Exudate is serum in the late incubation and early invasion, seromucus, mucus or mucopus in the later invasion and early establishment and pus throughout the full virulence of the disease, while termination is marked by a return to the normal, if at all, in the reverse order from fluid pus to pus shreds, then from free mucus to mucous shreds or mucus apparent only on chilling the specimen, and finally no exudate at all in complete cure. Chordée is confined to the male and is very painful erection, which is excited by the irritation within the canal of extensive urethritis reflexly upon the spinal cord. Distention of the bladder with urine in the early morning excites chordée also precisely as it does erections in normal men. The pain is due to the fact that the congestion, edema and infiltration of the corpus spongiosum urethræ deprive it of extensibility, so that while the corpora cavernosa penis distend and extend into the erection the urethra remains inelastic as a thick cord (whence the French term chordée) along the venter of the penis, compelling the organ to take a curve downward instead of upward. This strain on the urethra is excessively painful and may tear the mucosa at numerous points, thus setting up hemorrhage.

**Stages.**—Four stages are recognized for convenience of description: incubation, invasion, establishment and termination.

**Incubation.**—Incubation is marked by hyperemia and edema with few and slight subjective and objective symptoms.

**Invasion.**—Invasion adds to all these conditions. The latter is, therefore, the stage during which most patients present themselves. It is distinguished by desquamation of epithelium and the exudation of mucus and serum, with progressively greater subjective symptoms, pain being due to the denudation and infiltration.

**Establishment.**—Establishment adds free discharge, pus formation and extension along the canal until the whole urethra may be involved in the male and until either or both the external and internal sexual organs may be compromised in the female. The last condition is regarded as a complication exactly as is similar extension in the male of the disease into periurethral structures and organs.

The *complications* are appropriately a separate subject and are treated in Chapter II on page 82.

**Termination.**—Termination is distinguished by subsidence of all symptoms, often in a comparatively brief period in mild and uncomplicated cases, but usually in a really prolonged period, even months and years, in severe and complicated cases, which constitute chronic urethritis—a subject for individual discussion in the following chapters. The symptom last to leave during the termination is in most cases the discharge, which gradually decreases in amount and thickens in consistency exactly like the mucus from the bronchi after infection there.

Thus are produced the various kinds of shred in the urine in both sexes and strings of mucus in leucorrhea in the female.

**Nongonococcal Acute Urethritis.**—**Nonbacterial Nongonococcal Acute Urethritis.**—Nonbacterial nongonococcal acute urethritis shows no microorganism at all or none of importance as distinguished from the bacterial forms to be presently described. Primary disease is the rule, secondary forms are less common. Incubation is absent or short within a very few hours or a day and without definite symptoms. Invasion is very prompt after traumatism, physical by instruments, thermic by heat or cold, chemical by concentrated solutions, or early during an exacerbation of gout or rheumatism in diathetic urethritis, an outbreak of eczema or an attack of herpes in eruptive urethritis. Onset is also autogenous, self-induced by excess in venery, eating and drinking or by any other slight cause acting on a mucosa weakened by previous attacks. Inoculation by an acrid vaginal discharge associated with menstruation or leucorrhea occurs but would then suggest the bacterial form of the disease. Establishment is early.

The subjective symptoms are discomfort, rarely pain, variable pollakiuria, no hemorrhage unless from the causative traumatism directly, and a scanty exudate of serum and mucus, all in the mild cases which are the rule. Intense degrees of the disease simulate gonococcal conditions. Objective symptoms are the swelling of the mucous membrane and the exudate at the meatus and usually only in the first glass of urine in a two-glass test. Complications are rare. The stage of termination is brief and recovery complete.

**Bacterial Nongonococcal Acute Urethritis.**—Bacterial nongonococcal acute urethritis has microorganisms of great importance and shows primary cases by initial infection and not infrequently secondary cases from relapsing disease. Mild or severe cases are the rule and complications not unusual especially in the pyogenic form which is clinically indistinguishable from true gonococcal urethritis.

**Catarrhal Acute Urethritis.**—Catarrhal acute urethritis is an autogenous infection with *Micrococcus catarrhalis* previously either rendered active or the mucosa vulnerable to it or both through indiscretions in intercourse, food and drink or it is a heterogenous infection from host having an active form.

Incubation, invasion and establishment are short, as a rule, within a day or two: that is, about half the incubation of a gonococcal infection although longer delays are seen. The subjective symptoms are discomfort, irritation, moderate pollakiuria and seromucus discharge which become more positive during the invasion and later when the establishment is complete all these symptoms are somewhat augmented in mild cases and distinctly so in severe cases occasionally even to the degree of gonococcal infection. The objective symptoms are moderate edema at the meatus and profuse mucous or mucopurulent discharge. Associated catarrhs in other mucous membranes are not uncommon as in the nose and throat and in the female the external and internal organs may take part in the same process. Complications are rare. Termi-

nation is shown by a rather slow recovery, often leaving behind either a very slight exudate or a local weakness of the mucosa.

**Diathetic and Eruptive Acute Urethritis.**—Diathetic and eruptive acute urethritis are essentially autogenous conditions, sometimes without important bacteria, oftener with *Micrococcus catarrhalis* in a soil unhealthy and irritated by underlying disease, such as gout, rheumatism or eczema. Pyogenic urethritis may be similarly ushered in. Incubation is concurrent with the early period and symptoms of the causative disease during the first few days. Invasion, establishment and termination have the same clinical features as primary catarrhal urethritis, with those of the underlying disease added.

**Pyogenic Acute Urethritis.**—Pyogenic acute urethritis is exceptionally self-induced through the familiar three excesses which weaken the mucosa and stimulate the organisms commonly dormant as harmless saprophytes in the urethra, namely, *streptococci*, *staphylococci*, various bacilli and numerous other organisms, usually not pathogenic; but as a rule it is a direct infection by sexual intercourse, duly augmented by the foregoing elements. Incubation is much the same as that of gonococcal urethritis, from three to seven days in the primary cases and a shorter time in the secondary and relapsing cases. Invasion and establishment are marked with the same subjective symptoms in the urethra and during urination. The discharge is less seromucous and early more mucopurulent and purulent than in the preceding form of urethritis and likewise more copious. Objective symptoms chiefly concern moderate edema and a boggiess of the urethra as a whole and the profuse purulent discharge which cannot be distinguished from that in gonococcal urethritis except with culture and microscope. The gonococcus is often associated with pyogenic organisms in severe urethritis and is, therefore, always to be thought of as present in a pyogenic case which does not follow quite the typical course. Complications are almost as common in true pyogenic urethritis as in gonococcal lesions; in fact, by many it is considered as doubtful whether rheumatism of urethral origin occurs unless the pyogenic organisms are present. Termination is by the usual steps a slow recovery of the mucosa to normal in rather rare instances. More commonly permanent damage remains in the urethra and in the surrounding organs infected during the complications.

**Syphilitic Acute Urethritis.**—Syphilitic acute urethritis is generally chancreous and sexually acquired although under a long foreskin and within the folds of the vestibule of the vagina mucous patches during the second stage may involve the meatus in a local urethritis. The chancre is either meatal, namely, partly upon the glans or vestibule and partly within the urethra or endourethral—entirely in the canal. Incubation is typically twenty-one days, occasionally shorter, if mixed infection is present, and rarely longer if the history is correct and truthful. Invasion is marked by infiltration and a narrowing of the canal so that changes in the stream occur in marked cases but if the infiltration is of "parchment" type it may escape detection. Establishment of the

chancre or mucous patch is signalled by subjective symptoms in its period of ulceration through pain in urination over the eroded spot and the serous or serosanguineous discharge. Associated balanitis, balanoposthitis and vulvitis give a seropurulent discharge of typical appearance, consistency and odor, for which or for the secondary rash often present already the patient is more apt to seek treatment than for the urethral lesion itself. Objective symptoms are the infiltration, patches, rash, adenitis, *Treponema pallidum* and the blood reactions of Wassermann or Noguchi in the well-established cases, while the blood may be negative in the earlier cases. Cord-like, insensitive lymphatic channels leading from the lesion into the groins are common and early. Great edema of purple lividity and narrowing of the caliber of the urethra are seen. Urethroscopy is advisable in selected cases. Complications are rare and due to associated pyogenic infection and usually are summed up in focal phagedena and in suppurative adenitis in the groins. Termination results in the healed lesion with long persistent infiltration and at times permanent scar and deformity.

**Chancroidal Urethritis.**—Chancroidal urethritis is almost always a primary infection sexually acquired, rarely secondary by extension of a neighboring lesion or by infection with the finger of the patient or instruments. It seems to be chiefly meatal only, rather than endourethral, thus differing from the chancreous form in both sexes. Incubation is about one week, usually less, and has no special symptoms. Invasion is that of an open ulcer, with pain, pus, bleeding and ardor urinae. Extension and autoinoculation occur again, differing from syphilitic urethritis. Establishment marks the more severe and progressing symptoms while termination is never without permanent rough scar and deformity, although not always extensive.

**Herpetic Acute Urethritis.**—Herpetic acute urethritis is autogenous, never directly infected, and by some authorities is classed as diathetic. It is as lawless as herpes of the face. The objective symptoms show papules grouped about the meatus, glans and foreskin in males and in females about the vulva, which soon acquire vesicles, with serum, then seropus within them, which break down into little ulcers. These become covered with scabs in the healing stage.

The subjective symptoms are burning during the congestion, soreness during the ulceration and itching during the scabbing stage. Herpes is never endourethral.

**Gonococcal Acute Urethritis.**—**Clinical Varieties.**—The clinical varieties are hyperacute, acute, subacute and chronic, uncomplicated and complicated, of which the chronic and complicated forms are properly subjects by themselves and are so treated in this work.

Anterior and posterior urethritis is a classification of practical merit in that it respects anatomical subdivision of the urethra into the anterior and posterior portions at the triangular ligament, surrounded by the compressor urethrae muscle, and respects pathological findings of slightly different temporary, permanent and complicating lesions in these same two subdivisions, and respects clinical observation of totally



different symptom-complex in accordance with the part of the urethra involved.

Rapidity of onset, severity of symptoms, number and importance of complications and protraction in course all vary according to the virulence of the infection, the presence of other organisms associated with the gonococcus, the general health and resistance of the patient to disease in general, and to mucosal lesions in particular, and the early and properly applied treatment. It is fully established that the gonococcus itself varies widely in its virulence, so that Schwartz<sup>1</sup> has been able to differentiate at least four general varieties, comprising at least twelve subtypes in his gonococcal fixation test work.

**Anterior Gonococcal Acute Urethritis.**—The stages are incubation, invasion, establishment and termination. Anterior infection is clinically the earliest manifestation of infection and deserves careful study. Incubation has practically no symptoms and marks the period of proliferation of the organisms. In the first attack it usually lasts three days, occasionally reaches seven days and even longer, but in second and subsequent attacks it is liable to be shorter, especially if sequels of previous attacks are active, and it may be abbreviated likewise by all the causes of simple catarrhal urethritis. The point of incubation is at the meatus in primary sexually acquired disease, whence it extends through the anterior urethra up to the triangular ligament. After this it may invade the posterior urethra. Thus is constituted respectively anterior and posterior urethritis, with highly different symptoms. Progress to the neck of the bladder makes the posterior form. That form alone is seen in woman on account of anatomical arrangement. The symptoms of anterior and posterior urethritis also vary accordingly as the disease is primary, and extends from the meatus backward or secondary, starting at any point of the urethra from which it proceeds. The local subjective symptoms are a little indefinite sensation, which slowly increases, and is like the tickling of a hair or the creeping of a fly in and about the meatus. The local objective symptoms are redness and edema of the meatus, a drop of pus with loose epithelium containing gonococci. The first glass of urine is clear and free of pus, but may have delicate shreds or flakes and the second glass is clear.

The invasion marks the changes in the mucous membrane, beginning with early discharge and persisting a few days or a week. The local subjective symptoms are increased tickling, due to the early exudate, and slight heat, due to congestion and moderate frequency, and ardor of urination, due to the irritation and denudation. The systemic subjective symptoms are anorexia, malaise, fever and prostration. The more marked the symptoms the more severe is the attack likely to be, a fact which should be well borne in mind. The local objective symptoms are moisture, progressively serous, mucous and purulent, at times bloody, scanty or moderate in amount, gumming

<sup>1</sup> Schwartz and McNeil: *Loc. cit.*



the meatus together; gonococci abundant, with epithelial and white blood cells, and urine slightly turbid in the first glass and clear in the second.

The establishment begins at the end of the second week or even earlier and sometimes not until the third week. It is approximately true to say that a week is devoted to incubation, another to invasion and a third to the incidence of full establishment. The local subjective symptoms depend on the inflammation, its extension and penetration. Its chief elements are pain, disturbances of micturition, chordée and discharge.

The pain in severe cases is present in the quiescent state, due to the intensity of the infection; in the act of urination, due to the acidity of the urine and the denudation of epithelium; in the excitement of erection, due to the infiltration of the corpus spongiosum urethræ, with inflammatory exudate; and in emission, due to the added congestion and the alkalinity of the semen acting on the more or less raw epithelium. The pain is located in the anterior urethra and may extend backward even to the posterior urethra before the latter is really involved, and may be maximum at the meatus, both by referred pain process. It travels down the urethra, with the stream of the urine, until the whole canal seems afire. Pain during the quiescent state is present day or night, more or less constant and varying with the severity of the inflammation.

The urinary disturbances are regular accompaniments of the pain and due to the same general causes. Frequency may be very troublesome at first by day, later by night, particularly if the posterior urethra is even sympathetically congested. The stream is altered in size in any degree from normal to literal dribbling, and in form to forking, twisting and spattering, all due to the degree of edema and its effect on the course and caliber of the canal. Acute retention of urine is in intense cases often seen due to muscular spasm or extreme edema, or both, in the region of the compressor urethræ muscle. Moderate bleeding may be present.

The chordée or chorda venerea is a troublesome symptom commonly late in the establishment when the corpus spongiosum urethræ is widely and deeply infiltrated and the mucosa greatly irritated. Both these factors stimulate erections, especially with even a small quantity of urine in the bladder. The corpora cavernosa become turgid, firm and erect, while the corpus spongiosum urethræ, having lost its extensibility, elasticity and distensibility temporarily through the disease, can hardly alter its form, and therefore the attempt to stretch it causes it to stand out prominently as a thick cord along the penis, whence the term chorda venerea. The pain proceeds from the great tension on the inflamed tissue by the corpora cavernosa.

The discharge is augmented from the mucopurulent moderate drop of the invasion to a florid copious flow thickening from the stringy condition in the preceding period to that of cream and changing in color from a watery white to yellow then greenish, staining the cloth-

ing of body or bed with a thickish incrustation at the center, thinning out at the margins through the watery elements.

The systemic subjective symptoms vary widely, are absent in mild cases and pronounced in severe cases, especially with mixed infection, and are chiefly those of any septic absorption, anorexia, constipation, anemia, depression, prostration, chills and fever and insomnia. They need no detailed discussion.

The objective symptoms should be noted in regular anatomical order and are due to the inflammation and its accompaniments in the mucosa, bloodvessels, lymph vessels, discharge and urine.

Redness and edema affect the lining of the foreskin and the glans, which may become greatly excoriated, with blotches of shining red scattered over pus-covered surface. The foreskin as a whole may be almost densely infiltrated and phimotic. Lymphangitis may early be visible, palpable and tender but is more often buried in the edema. The meatus is reddened for a variable zone over the glans, very edematous even to eversion and sometimes excoriated. The urethra is infiltrated thick, inelastic and tender and often shows its involved mucous glands as shot-like spots along its course. The discharge is a constant dropping of pus changing in amount, color and consistency as just noted under local subjective symptoms. Owing to the hours of sleep, the early morning flow of pus represents the all-night accumulation and is, therefore, the most copious except when severe disease disturbs the patient for frequent nocturnal urination. The urine in test glasses is very turbid in the first and clear in the second glass in the mild cases or slightly turbid in the severe cases, depending on the thoroughness with which the urine washes the pus before it into the first glass. It is obvious that a copious flow of urine even in a severe case will tend to produce a clear or nearly clear second glass while a scanty flow will have the opposite effect. A practical point of importance therefore is to have the patient call with as much urine in the bladder as may be retained without pain—four or five hours' urine is a good supply when possible.

The termination usually begins after the establishment has run a course of about two weeks, rarely less, not uncommonly more than two weeks. It is broadly true to say that the average case not characterized by severity or complications requires about two weeks each for the incubation and invasion together, the establishment and the termination each, in all six weeks, although the term "termination" may thus only mean the disappearance of active subjective symptoms, because very few cases are without a semichronic or chronic "shred" stage. As previously stated, chronic manifestations will be discussed separately. The local and systemic subjective symptoms are a gradual but unmistakable decrease, usually in the reverse order of their appearance. The discharge becomes more watery and sometimes more copious in this thin condition, then changes from the green to the white mucoid consistency and finally thickens into shreds, which may be the last of all symptoms to disappear. Chordée is quickly decreased

in severity and frequency, a fact which usually initiates the period of improvement. Urination is much less frequent first at night, then by day, and is soon normal. Pain loses its aggravating qualities and is finally a mere discomfort. The general health improves, fever and chills subside, appetite returns, better spirits replace depression and prostration and disappearing absorption corrects the anemia.

The objective symptoms are a thinning and decrease of the pus from the purulent through the mucous and serous stages to shreds. Gonococci are progressively fewer and harder to find without and with associated organisms in the so-called mixed infections. Epithelium in flakes and single cells is more abundant, the pavement type around the meatus, replacing the columnar type of the canal as a whole. All test glasses of urine are clear, the first alone contains heavy shreds of mucopus, which sink, and lighter shreds and clouds of mucus which float; both are germ-laden at first and finally may be germ-free as the case becomes cured. The author's seven-glass test is of great value in the diagnosis of this stage. Its details are given under the subject of Posterior Urethritis and Diagnosis on page 75.

*Duration of the Disease.*—The persistence of symptoms varies with the severity and nature of the infection, the resistance of the patient, the attention given by himself and the treatment prescribed. Infections in which the gonococcus is associated with the pyogenic organisms are apt to be long cases. Broadly speaking, the average case lasts for six weeks, at least so far as the obvious symptomatology is concerned; many cases, however, which have given the patient little or no distress will last as many months before cure.

*Relapses.*—Recrudescence of symptoms is by no means uncommon from foci chiefly in the glands of the mucosa, through unusual penetration of the disease or anatomical complication of the glands, or both whence arise chronic forms of the disease. Although in very many cases the mucosa as a whole recovers in a much larger number localities of deep damage or destruction persist for many years of life.

### DIAGNOSIS IN GENERAL.

**Basis.**—Independently of whether or not the lesion is nongonococcal or gonococcal, the diagnosis rests on four elements: history, symptomatology, physical signs with laboratory findings and treatment, as fully set forth in Chapter VIII, on the General Principles of Diagnosis. The chief element of diagnosis and differentiation is the recognition and demonstration of the infecting organism. All varieties of nongonococcal and gonococcal urethritis may and usually do give a sexual history concerning which denials are commonly falsehoods. Catarrhal and diathetic urethritis may legitimately have no sexual history. In the symptomatology all forms agree as to the kind of symptoms, as has already been fully discussed. The degree of suffering, however, is severest in the suppurative and gonococcal infec-

tions, which are almost indistinguishable on this point. The location of the symptoms may be meatal or preputial in the chancroidal and syphilitic types but urethral in all the other forms. The physical examination serves to verify the situs of the lesion and urinary study in the Thompson two-glass test or the author's seven-glass test closely resemble each other. Pus is most abundant in the suppurative and gonococcal forms and usually least in the syphilitic and chancroidal lesions, leaving catarrhal, diathetic and traumatic urethritis as the usual mean. The laboratory findings must determine by smear and culture the infecting organism or other definite cause. Catarrhal urethritis arises from the *Micrococcus catarrhalis* and diathetic chiefly from diabetes and lithiasis. Suppurative urethritis predominates in the pyogenic organisms, chiefly the *Streptococcus* and *Staphylococcus pyogenes*, while traumatic may be without pathogenic germs and abundant in exfoliating epithelium and detritus. Syphilitic urethritis must show the *Treponema pallidum* and sooner or later a positive Wassermann reaction, and chancroidal lesions contain the *Bacillus of Ducrey*. Gonococcal infections must show the *diplococcus* of *Neisser* in smear and culture and in the severe and complicating lesions a positive gonococcal complement-fixation test. The treatment serves to emphasize the correct findings. Tonics are a local and systemic aid in catarrh of the urethra. Relief of the diabetes and lithiasis reaches the diathetic type and removal of offending causes demonstrates traumatic urethritis. Antisyphilitic measures, surgical attention to the chancroid and the means of treatment hereinafter set forth are all indices of the nature of infection in syphilitic, chancroidal and gonococcal disease.

**Differential Diagnosis.**—Gonococcal urethritis is distinguished from the various nongonococcal varieties, comprising catarrhal, diathetic, pyogenic, syphilitic, chancroidal and traumatic, as most important.

**Nongonococcal Acute Urethritis.**—General differentiation respects history, subjective and objective symptoms, laboratory examination and treatment exactly as in gonococcal invasion. The technic is the same for securing and preparing smears for specimens on the microscopical slide and cover glass and on culture media for growth in the laboratory, whether from free discharge or drops or only shreds in the urine. The author's seven-glass test is available for demonstrating the site of the urethra involved but only in prolonged and complicated cases. The gonococcal complement fixation test is of value in the same general type of disease for proving the absence of gonococcal absorption, but is of no value in mild forms. The Wassermann reaction becomes of value when syphilis is suspected. The special features of each form are outlined as follows:

*Catarrhal* Differs from *Gonococcal Urethritis* in the etiological factors stated in the clinical section, page 23, having a history of low vitality, alcoholism, frequent catarrhal disease elsewhere in the body and perhaps many previous urethrites of gonococcal or other nature. These are admitted causes of frequent congestion in alcoholism, hyperacidity

or hyperalkalinity of the urine, sexuality and even infection. Peri-urethral disease, especially prostatism, must be remembered. The subjective and objective symptoms rule as those of a mild urethritis with little discomfort on the part of the patient except the mucopurulent discharge and include the diathesis or disease underlying the outbreak. In the laboratory there are no gonococci but only the *Micrococcus catarrhalis* and occasionally no organisms at all in the simple indolent mucous discharge. The blood tests are negative for both gonococcal and syphilitic infection. Treatment completes the diagnosis in that mucous membrane restoratives internally administered and in that attention to the underlying diathesis both help more than local application which not infrequently increases the discharge and the discomfort. There are no complications or sequels.

*Diatetic Differs from Gonococcal Urethritis* in having gout, rheumatism, intestinal toxemia and disease, constipation, diabetes, lithiasis (gravel) or the strumous state prominent in the history. Many of these cases admit frequent attacks of balanitis in the midst of such sickness associated with the urethritis. The subjective and objective symptoms relate chiefly to the antecedent attack of the disease and to a peculiar relaxed mucosa perhaps with discharging balanitis. The discharge is mucopurulent or purulent according to severity. There is much more suffering from the antecedent systemic disease than from the urethritis. The laboratory proves no gonococci present and occasionally no organisms but much more commonly the pyogenic germs and others common in the urethra occur. The *Bacillus coli* may be expected in intestinal cases. Both blood tests—gonococcal and syphilitic—are negative and the treatment requires relief of the underlying disease with immediate benefit to the urethritis which is cured by mild local injections or irrigations of astringents at suitable temperature. The mucosæ of these subjects are so irritable that only the simplest means should be initiated. There are no complications or sequels.

*Pyogenic or Purulent Differs from Gonococcal Urethritis* in its infection with soiled instruments or other failure of asepsis or from a pus focus elsewhere in the urogenital tract in the history. Many of these cases are infected from perverted intercourse and show the pus found in the mouth while others are evolved from normal intercourse. The subjective and objective symptoms always duplicate in kind and frequently in degree those of gonococcal urethritis, so that every element is present except the gonococcus and all the findings in the author's seven-glass test or other multiple-glass tests are the same. Fever, absorption and prostration are by no means uncommon in many of these patients. Laboratory examination reveals a multitude of pyogenic organisms in smears and culture, but no gonococci. The blood test is likewise negative and reliable in the prolonged and complicated cases. Treatment by relief of the primary focus aids all the local measures already mentioned under the treatment of gonococcal urethritis (page 47). Not infrequently the same sequels and complications occur as are found in the latter disease.

*Syphilitic or Chancrous Differs from Gonococcal Urethritis* in its long incubation, in the history and the situation of the lesion at the meatus or inside the urethra and the subjective and objective signs are those of a slight stricture, at the meatus or fossa navicularis, a thin discharge with a little blood or pus, usually hard insensitive lymphatics and rarely chordée. *Ardor urinæ* may be the sole complaint. The multiple glass tests show little or no discharge. Secondary lesions are present in cases six or eight weeks old. The typical chancre and usual varieties are fully described under *Balanitis* and need not be repeated here. The urethroscope, preferably the short open end Chetwood



FIG. 6.—Phagadenic paraphimosis. The peculiar destruction of the foreskin and glans is apparent. The lesion contained no tubercle bacilli, no *treponema pallidum* and seemed to be made up of indolent granulation tissue on pathological examination. (Unpublished case of Dr. C. J. Seay.)

tube (Fig. 145) or the meatoscope (Fig. 136) will often make the diagnosis of the lesion within the canal. In the laboratory the *Treponema pallidum* is recognized readily from the secretion of accessible lesions, but is secured with difficulty from those within the canal. The Wassermann blood test appears about the second week, occasionally earlier. The gonococcus is absent in the specimen. Treatment locally and systematically directed against the syphilis gives very rapid and wonderful relief still further completing the evidence of this special infection.

*Chancroidal Differs from Gonococcal Urethritis* in showing a painful actively inflammatory and extending sore in its history, situated at the

meatus or within the canal and causing the subjective and objective symptoms of a "mouse-eaten" base, undercut and overhanging edges, inflamed annexa and often painful lymphatic vessels and glands. There are purulent discharge and detritus which show in the first glass of the multiple-glass tests but rarely sufficiently to make a large specimen turbid. Ardor urinæ is common and rather distinct at the meatus. For the laboratory the *bacillus of Ducrey* is recovered from curettings. There is no *Treponema pallidum* or Wassermann test and no gonococcus or gonococcal fixation test and the treatment with antiseptic dressing, washing and ointment will relieve and show the simple surgical character as compared with the chancre as a port of entry of systemic infection. The sequel is deformity and sometimes stenosis of the meatus and the complication suppurative inguinal adenitis.

*Traumatic Differs from Gonococcal Urethritis* in emphasizing injury in its history as the cause, due to instruments, caustics, heat or electricity, and in having as the subjective and objective symptoms mild or severe hemorrhage, catarrhal or purulent discharge, marked ardor urinæ and chordée according to the nature and severity of the excitant. Instruments usually cause hemorrhage from their mechanical irritation, followed by catarrhal urethritis unless the instruments were infected. The other causes named produce superficial destruction of the mucosa and pus with all its other symptoms. In the laboratory specimen there may be no organisms at all or the *Micrococcus catarrhalis* or the pyogenic group according to their entrance after the traumatism. There are, therefore, no gonococci, no *Treponema pallida* and no *bacilli of Ducrey*, no Wassermann blood test and no gonococcal fixation test unless the traumatic urethritis was induced during the treatment of any of the other forms. Treatment by removal of the cause makes the diagnosis immediately. This should be followed by the simpler means of controlling the rest of the reaction. Severe cases have the sequel of stricture as in the author's case of burn of the urethra referred to in the chapter on Stricture, and some patients may have such complications as extension of the inflammation outside the urethra in rare examples.

**Gonococcal Acute Urethritis.**—General differentiation is exactly the same as that described for nongonococcal acute urethritis in the earlier paragraphs of the subject of diagnosis. The reader need be reminded only of the four general factors of history, symptomatology, laboratory investigation and treatment. Attention to these details will readily establish the diagnosis and the minute distinctions from the other forms of acute urethritis are already given under each such form in the paragraphs on the differential diagnosis.

It must not be forgotten that the gonococcus must be searched for in smear and culture, repeatedly if necessary, and that in severe or complicated cases the gonococcal complement fixation test must be performed.



## TREATMENT IN GENERAL.

**Gonococcal Acute Urethritis.—Prophylaxis.**—The entire subject of prevention is treated in the Chapter on the General Principles of Treatment under the subheading Prophylaxis (page 483), to which the reader is referred.

**Management.**—General Principles of Treatment in Chapter IX, on page 483, embraces all the procedures of management.

**Abortive Treatment.—Definition.**—Abortive treatment may be regarded as immediate cure of the infection when only the early subjective symptoms are present and when the sole objective signs consist of few intracellular and extracellular gonococci with scattered desquamated epithelia and still fewer pus cells but no fluid pus and no true exudate of leukocytes. The period for the application of the treatment in most patients is preferably the first twenty-four hours, rather than the second twenty-four hours.

**Limitations.**—The limitations arise from the difficulty of having patients respect advice to call at the earliest moment, or of having them rightly perceive and interpret the early symptoms and then come for aid at the golden moment of slight exfoliation rather than at the later time of exudation and discharge.

**Technic.**—The technic is threefold, as generally recognized of reasonably reliable results:

1. Application method.
2. Irrigation method.
3. Instillation and retention method (Ballenger).
4. Disapproved methods, such as dressings, bougies and scrubbing of the urethra.

1. *Method of application* implies one treatment as sufficient and embraces the following steps: The patient evacuates his bladder, thus washing the urethra from behind forward throughout under Nature's own method. Cleansing is further assured by filling a 150 c.c. Janet-Frank syringe with 2 or 4 per cent. boric acid water at 100° to 105° F. and connecting it with a soft, short 12 French catheter inserted for about 3 inches into the canal and then by flushing the urethra from behind forward while the patient is in the recumbent position. A short Chetwood urethroscope is passed into the canal, its obturator removed and then its sheath slowly withdrawn while a cotton applicator dripping with from 1 to 3 per cent. nitrate of silver solution is gently rubbed on the mucosa, or a few minims may be left free in the bottom of the tube during its deliberate removal. Either application should stain the mucosa a faint white. The immediate results are sterilization of the infected area and a secondary chemical urethritis of mild degree and brief duration having a mucopurulent or purulent discharge and moderate ardor urinæ which steadily decrease under rest in bed, light diet, free bowels, cold locally, neutral urine and anodyne mixtures, exactly as suggested in fully established cases of acute urethritis in the



following paragraphs. A soothing astringent hand injection of half-strength Ultzmann is occasionally necessary. The final result is destruction of the gonococcus proved by smear and culture exactly as was their presence recognized at the first call, also a restored mucosa proved by the absence of desquamation and red and white blood cells. The whole procedure is strictly an analogue of Credé's method of treating the eye of the newborn infant. The 1 per cent. silver nitrate dropped into the eye causes death of any organisms present and induces a moderate catarrhal conjunctivitis whose irritation is allayed by local applications of normal salt solution or boric acid water.

2. *Method of irrigation* requires one or two treatments a day for two or three days in accordance with the microscopic findings and the activity of the response. The patient passes his water to remove all possible material and the urethra is further cleansed by the boric acid water irrigation of its terminal three inches, as detailed in the method of application. A 150 c.c. Janet-Frank syringe and catheter are now filled with antiseptic solutions at 100° to 110° F. and flushed through the meatal three inches of the canal from behind forward. Suitable strengths are somewhat stronger than those employed in the irrigation method of the early stage of true exudation because the disease has not yet penetrated deeply. Examples are:

Silver nitrate solution . . . . .	1 in 5000 to 1 in 3000
Argyrol solution . . . . .	3 per cent. to 10 per cent.
Protargol solution . . . . .	0.5 per cent. to 1 per cent.
Potassium permanganate solution . . . . .	1 in 2000 to 1 in 1000
Bichloride of mercury solution . . . . .	1 in 5000 to 1 in 3000

The stronger solutions are best on the first day and the weaker selections on the second and third days, if the reaction permits. In general the earlier the case, the stronger and less frequent the irrigation within the foregoing limits which are always safe. If the case is seen later but still before the true exudation of leukocytes comes with pus cells more numerous, epithelia more frequent, a few red blood cells and a mucopurulent instead of a mucous stickiness, as is the case on the second or third day, then the irrigations may be a little weaker, more copious and given twice daily. The immediate results should be disappearance of the gonococci with a secondary mild catarrh, exactly as in the method of application in its nature and treatment and the end-results are complete restoration of the mucosa. If the gonococci persist after the third day of such treatment it may be regarded as a failure and the standard continuous method of treating the disease should be undertaken.

The author's experience with social prophylaxis duplicates that of every other observer to the effect that printed circulars or leaflets of instruction are of benefit and that cases within wedlock are usually successful, especially among intelligent patients who after explanation comprehend and remember instructions and then follow them out. It is impossible to say anything worth while about the unintelligent.

*Janet Method.*—This is also an irrigation method and is fully described under the standard treatment of urethritis by irrigation (page 64). Its cautions are four—which are that the patient must always urinate first, that the irrigation must reach only the anterior urethra, that the temperature must be moderately hot, from 100° to 110° F., and that the concentration must be relatively weak, 1 in 8000 to 1 in 4000 watery solution of potassium permanganate in water, and that the repetition should be not more than twice daily.



FIG. 7.—Assorted syringes. A, triumph two-dram asbestos packed all glass syringe for patient's use, with box; B, patient's urethral hand syringe, with rubber bulb and ejector; C, acme subpreputial syringe, with long rubber tip, glass barrel, metal cap, glass piston and cotton packing; D, triumph all glass asbestos packed, long tip model; E, Hayden metal mounted glass barrel leather packed cone point instillation syringe, with shoulder made flat by the author to prevent rolling.

3. *Instillation and Retention Method.*—Ballenger<sup>1</sup> denominates this the "Sealing-in Abortive Treatment of Beginning Gonorrhea," seems to be the originator of it and claims that "we have probably administered 4500 of these treatments during the past four years and have never seen a stricture or any other harmful results produced by them." Its basis of success is application during the first twenty-four to forty-eight hours of the disease of 5 per cent. *freshly prepared* argyrol solution once daily for five days with retention for at least six hours by

<sup>1</sup> Genito-urinary Diseases and Syphilis, 1913, pp. 15-21.

## ACUTE URETHRITIS

means of a collodion cap upon the glans. The organisms are reached and destroyed throughout the length and depth of the infected area at this early stage and gonococci, staphylococci, colon bacilli and pseudogonococci are equally well destroyed. No harm to the inflammation occurs if the method fails. Its basis of failure is intercourse during the incubation period, a prolonged incubation, early follicular abscess or involvement, and any form of other treatment such as irrigation, instrumentation and deep injection, because such invite extension of the infection beyond the zone benefited by the sealed-in instillation.

JOHN JONES

### Chart 1

'Ac. Gonoc. Ant-Post. Urethritis.

[illegible]

**FIG. 8**

In the technic the patient's bladder must be empty and kept as little active as possible by greatly limited fluids and food during the period of retention, which is about six hours each day for five days. In the recumbent position, the glans penis is carefully cleaned, dried and surrounded with a sterilized towel. With a cone point urethral syringe 25 minims and *no more* of a 5 per cent. watery solution of argyrol are gently instilled into the anterior urethra in all cases except those which are seen on the second or third instead of the first day. In these

patients the medicine is gently massaged backward in order to provide contact with the more extensive infection of the mucosa. As the syringe is removed, and while the massage is performed if done, the meatus is compressed shut from side to side, dried carefully with the towel and then covered with a plug of noncontractile collodion (U. S. P.), which dries while the urethra is still kept closed.

The patient is now allowed to go home and to observe the following strict precautions: abstinence from violent exercise, fluid and food, except in moderation, and sexual stimulation. At the end of about

Chart 4:

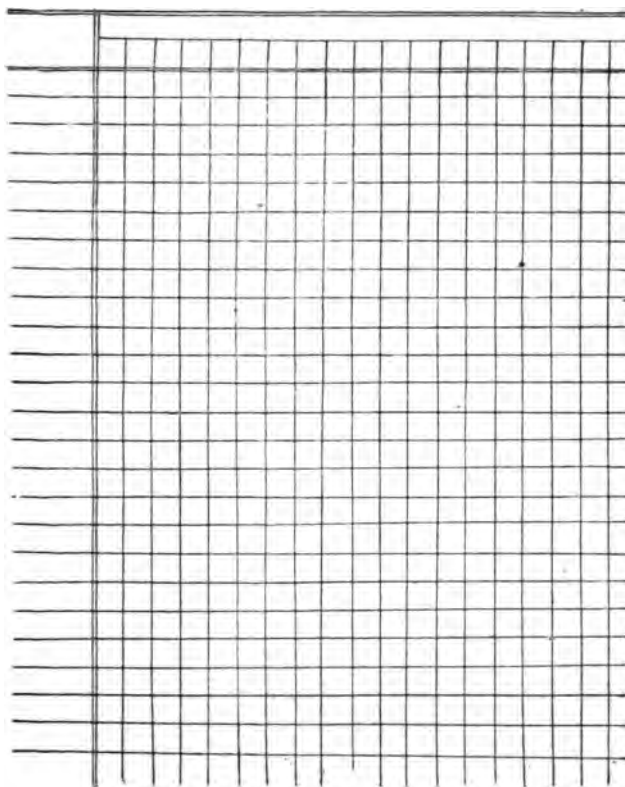


FIG. 9

six hours the collodion plug is removed by softening it with acetone or by pulling it off by means of the cotton handle secured at one edge but always away from the meatus because if the cotton handle reaches the meatus it will drain off the argyrol. After the plug is removed, the patient drinks copiously of alkaline water so as to flush out the canal with neutral urine and to relieve the chemical and mechanical irritation essentially secondary to this procedure. The following day for a brief period he takes little fluid or food so as to limit the excretion of

urine and so as not to interfere with the treatment and then reports for the second application. This procedure is repeated once a day for five days. The presence of the gonococcus at this time usually indicates failure and resort to the standard methods of treatment. While the argyrol is retained it is well to have the patient wear a light cotton dressing for the discovery of leakage if the collodion breaks or loosens. Beginning the treatment with 5 per cent. solution, gradual decrease in the strength to 3 or 2 per cent. may be followed especially if the chemical reaction seems active. Relapses of the urethritis after the five days of treatment are over mean failure of penetration or extension of the argyrol to coincide with the zone of infection and may be checked, if not violent, by a repetition of the procedure before the standard treatment is undertaken. The technical difficulties of this method are not insurmountable and Ballenger recommends that the beginner acquire skill by trying it on chronic cases which are in no wise adversely influenced by it.

*Aftertreatment*.—These measures in Ballenger's method are only observation to see that the medication has not induced a chemical urethritis which should be treated as shown under the subject of Traumatic Urethritis (page 305).

*Cure*.—This term involves relief of the infection and therefore freedom from any of its developments.

4. *Disapproved Abortive Methods* are the urethral dressing, as recommended by Boureau,<sup>1</sup> and urethral bougies. Both these are medicated, but the cotton or gauze in the former and the gelatin in the latter act as foreign bodies, irritate the mucosa and excite rather than check the infection. Scrubbing of the urethra with a brush, such as is used for tubes, suggested by Huguet,<sup>2</sup> only denudes the epithelium, which is exactly what the gonococcus does and therefore only leads to its rapid extension, although the theory was that of affording penetration of antiseptics to the deeper layers of epithelium into which this organism penetrates.

*Curative Treatment*.—*Classification*.—As in every chapter concerned with clinical features and complications, anterior and posterior urethritis will be separately considered and the gonococcal infection will be regarded as the type and other forms will be described thereafter, with their variations.

*Case Records*.—No case may be comprehensively and systemically followed without office records. The author's<sup>3</sup> history charts are shown in Figs. 8 and 9. Symptoms and remedies appear in the left-hand column, dates are at the top of the small columns and progress is algebraically indicated in them.

*Methods* are two—(1) the conservative expectant or antiphlogistic method, which is the older, and (2) the irrigation or Janet treatment, which is the newer. Each has its strong advocates.

<sup>1</sup> Moscow International Congress, 1897.

<sup>2</sup> Tr. Am. Urol. Assn., 1913, p. 163.

<sup>3</sup> Thèse de Paris, 1888.

**Anterior Gonococcal Acute Urethritis.—Conservative Method.**—This treatment is also called expectant because the various stages of the disease are awaited in their development before additional measures are adopted, likewise antiphlogistic because it gives particular attention to the local and systemic febrile characters of the lesion. Its aims in general are those of treating the acute and early establishment differently from the subacute later and declining period, to the degree that in the former no antiseptics are locally applied to the urethra by hand injection or irrigation while these measures feature the latter period. The advantages are that it is the method of least disturbance of Nature's processes concerning the inflammation, the plan of fewest complications induced by overtreatment, the procedure of greatest safety for the inexperienced nonspecialist, the treatment of least meddling and the management of fullest respect for the course and stages of the disease, with minimal interruption and interference. Its disadvantages are delayed antiseptic attack on the gonococci, the relatively slower though more gentle uncomplicated course of the disease and the dissatisfaction of many patients, with the fact that "nothing is being done" during the first two weeks.

*Stages of incubation and invasion* are managed as set forth in the paragraphs on Prophylactic and Abortive Treatment on page 47, and will not be further discussed here.

*Stage of establishment* requires attention to the general details of management and internal and local medicinal measures.

The dressing of choice is a piece of gauze about 6 inches square, with a small hole cut at its center through which the glans penis is passed after retraction of the foreskin. With the gauze resting in the corona the foreskin is replaced, thus leaving a loose apron which does not imprison the discharge within the urethra. The preliminary and final adjustments of this dressing are shown in Figs. 10 and 11. This dressing should not be allowed to adhere to the meatus and glans and should be changed approximately at every urination, at least every two or three hours by day and once or twice at night during wakefulness. In the circumcized and patients without average foreskins a larger piece of gauze may be prepared with a hole through which the penis passes freely, whose margins are pinned on each side of the penile opening in the suspensory bandage. The wearing of a cotton plug inside the foreskin and against the meatus is to be condemned because it holds the discharge inside the urethra and directly defeats Nature's aim at cure of the disease by the free production and discharge of pus and gonococci which by retention are favored in their characteristic powers of penetration. The patient cannot understand this result too well. So-called "gonococcal penile bags" are not advised unless several are purchased so that only clean ones, free of dry or moist pus, are in use and also unless they are large enough and hung low enough to prevent the meatus from resting on the cotton at the bottom and thus again being plugged. Muslin or linen bags do not sweat the

parts as much as rubber ones. It is well known that heat and moisture favor multiplication of organisms.

Prophylaxis is important and in this connection differs from introducing this chapter and is concerned with the eyes of the patient and infection of innocent associates. The eyes are guarded from contamination by the simple rule of great cleanliness of the hands, especially the finger-nails, which should be carefully cleaned whenever the patient uses the toilet or in any way treats his disease. A curious habit to be corrected is that by which many patients wash their hands but they adjust their clothing, which is at least theoretically always contaminated, and therefore again renders their fingers dangerous to



FIG. 10.—Gauze dressing during the acute stage; the glans is passed through the hole in the gauze to the sulcus with the foreskin fully retracted.

eyes. The hands should be washed last after every other detail has been provided for. The patient's associates are protected by having the patient, as far as possible, sleep alone and use separate toilet articles, especially such as come into contact with his hands, body and face, notably towels, wash-cloths, handkerchiefs, napkins and the like. All dressings should be placed in cheap bags or envelopes and burned—a plan which permits the business man to seal his dressings up until he reaches home for their destruction. Nothing that is insoluble in water should be thrown down a toilet, so that such disposal of cotton and gauze should never be attempted because they stop up plumbing. Similarly, syringes and other appliances should be kept apart, and

best type of the former is now sold in wooden boxes, which keep them away from the lining of pockets and handkerchiefs therein (Fig. 7, A and B).

**Management.**—This topic is discussed and detailed in Chapter IX, on the subject of General Principles of Treatment on page 483.

Leaflets and pamphlets of instruction such as the following cover all the ground clearly. It has been used by the author for many years in clinical practice and is founded on one by the late Follen Cabot.<sup>1</sup> In private practice a reprint of the author's article is given to patients, with instructions on Gonorrhea."<sup>2</sup>

Medicinal measures include those for local and systemic administration and for pathologic and symptomatic indications.



FIG. 11.—Represents the gauze gathered in front of the glans, and when thick for a copious discharge held closed for receiving the pus. The foreskin is shown pushed forward over the glans and the gauze to hold it in place.

Local subjective symptoms have been given in the clinical sections (page 34) as pain, urinary disturbances, chordée and discharge. The following suggestions apply to each in turn:

The pain, by local treatment, is relieved by hot baths to withdraw congestion from the urethral mucosa, consisting in penile, sitting and

<sup>1</sup> The Importance of Systematic Education of Hospital and Dispensary Patients Afflicted with Venereal Disease, 1907.

Long Island Med. Jour., October, 1907, i, 411.



# INSTRUCTIONS TO THOSE HAVING GONORRHEA

This disease is also called clap, claps, drippings, drips, runnings, runs, woman's fever, strain, urethritis, specific urethritis and gonorrheal urethritis. All these names mean the one and same disease.

Your disease is not a simple but a serious matter, and requires great care by the doctor and strict obedience to directions by you in order to restore the organs to perfect health. It is, therefore, necessary that you do with faithfulness what the doctor orders. If you do not it is possible that the disease will produce later in your life serious conditions in the bladder and kidneys, for example, which may not only damage your health, but also threaten your life.

Gonorrhea is a communicable disease and in order to avoid infecting other persons, and in order to prevent such complications as bubo, swollen testicles, abscess and stricture, the following rules should be observed:

Do not drink any liquor whatever that contains alcohol, because the alcohol in the urine damages the diseased parts.

Do not drink any spicy soft drinks like ginger ale and sarsaparilla, and do not eat peppery or spicy foods or pickles, because all these substances in the urine damage the diseased parts.

Do not drink tea, coffee or cocoa for the same reason.

Do not indulge in any sexual intercourse what-

until recommended and by the physician

Do not take violent exercise such as bicycling, running, rowing and the like. It is, however, not necessary to stop work at your trade or in your business.

Do not indulge in any sexual excitement whatever, such as kissing, fondling and "playing" with women, because even this form of sexual gratification always prolongs and aggravates the disease through the erection of the penis usually caused by it.

You must wear a well-fitting suspensory bandage with one waist and two thigh straps.

You must wash and dress the penis with the gauze apron at least three times a day as directed by the doctor.

Do not use cotton over the mouth of the penis, because it corks in the discharge, and do not wear the so-called "gonorrheal bag," because it soon becomes smeared inside with the pus and is then dangerous.

You must always burn all soiled dressings.

You must always wash your hands after dressing the penis because the discharge is blinding, and may be carried to the eyes and to innocent parties, such as children, by fingers dirty with the pus.

You must sleep alone, or always on the same side of the bed, and be particularly careful that no one else uses any of your toilet articles, particularly towels and wash-cloths.

When leaving should wear case each day if

You must drink plenty of water to dilute the urine, and to increase its quantity, thus washing away the discharge.

Stop the water-drinking five or six hours before going to bed, so as to secure complete rest from emptying the bladder during sleep.

You must eat chiefly toast, bread, butter, eggs, fish, oysters, clams and chicken, unless otherwise directed by the doctor.

You must remain reasonably quiet.

You must take the medicine regularly as directed.

You must treat the chordae by wrapping cold wet cloths about the penis, and after the erection has subsided, by emptying the bladder. Never force the erection down, as you may rupture the penis.

You must come for treatment with as much urine in the bladder as possible at each visit, so as to pass it in the doctor's presence for his examination. This is very important.

You must see the doctor as often each week as he directs, so that he may relieve promptly and quickly any new symptoms as soon as they arise.

Shreds or floaters in the urine usually show that you are not yet well, and are still in a condition of danger to yourself and to any pure woman whom you may marry. Whether or not a floater is important may be determined only by the doctor after microscopic examinations.

even body baths, of a temperature to produce redness of the skin and continued fifteen to thirty minutes until pain is alleviated. When a special tub is not available the effect of a sitting bath is obtained by drawing twelve inches of hot water in a common tub and by having the patient sit in the water with his legs extended. All baths should be taken at night, so that the patient may step from the tub into bed, otherwise chilling of the surface will augment the disease and perhaps add a severe cold. When heat fails, cold in the form of an ice-bag applied to the pubic region or perineum or of a wet dressing kept on the penis is of service. Through internal administration neutral copious urine avoids the pain caused by acidity, tends to limit the inflammation, so that chordée may be escaped, and flushes out the discharge. Litmus paper must be used to show neutrality. The following formulas are of service in neutralizing the urine and increasing its flow in addition to the various drinks stated under that heading:

R—Bicarbonate of soda, in tablet or powder, grains 5 to 20 three times a day.

R—Bicarbonate of potash . . . . .	30 grammes (1 ounce)
Tincture of hyoscyamus . . . . .	15 grammes ( $\frac{1}{2}$ ounce)
Distilled water up to . . . . .	240 grammes (8 ounces)

Mix, make a solution and mark:

One tablespoonful in a small glass of water three times a day, two hours after eating.

R—Salicylate of soda . . . . .	0.75 grammes (12 grains)
Bicarbonate of soda . . . . .	0.75 grammes (12 grains)
Benzoate of soda . . . . .	0.75 grammes (12 grains)

Mix, make a powder and mark:

Take 1 powder with a glass of water three times a day, two hours after eating.

Such combination may be directed as a powder three times a day, or with any one or two of the ingredients omitted, it is very serviceable, or it may be made into a solution with a tablespoonful dose. Milk, either ordinary, predigested or fermented, and alkaline mineral waters, such as Vichy, are very acceptable and useful either alone and separate or mixed in equal or other proportions.

Avoidance of sexual excitement, direct and indirect, by eliminating its congestion reduces the pain of erection and of ejaculation and blood-letting in the form of several leeches applied to the perineum but not to the penis or scrotum may be employed in extreme pain of congestion and edema, with obstruction and retention of urine.

Urinary disturbances are frequency, altered stream and acute retention. Frequency is benefited by limiting the intake of fluids to moderation, so that urination occurs not more frequently than once every hour or preferably every two hours. Constipation by congesting the prostate may also cause frequency without the presence of posterior urethritis. Altered stream is usually due to edema and is benefited by hydrotherapy—penile, hip and body baths—in the earlier periods and in the later periods by properly selected and applied hand injections. Acute retention is dealt with in its own section (page 78), but in mild forms is released by the hot baths and anodynes and antispasmodics, of

which none are better than Magendie's solution of morphin, minims 6 to 8, hypodermically, for definite cases, or codein sulphate, grain  $\frac{1}{2}$  to 1, by mouth, every five hours, or an opium suppository, grain  $\frac{1}{2}$  to 1, once or twice a day. The advent of intense retention requires relief of the bladder by suprapubic aspiration with a long medium caliber needle. Catheterization in any form whatever is absolutely forbidden, for fear of infecting the bladder.

The chordée is possibly prevented by all the means suggested for allaying inflammation and edema in the prevention of pain, of which chordée may be regarded as one manifestation. Cleanliness of the foreskin, freedom from tight gauze dressings about the glans, proper fitting of the suspensory bandage, regular easy evacuation of the bowels, rest and quiet in avoidance of the congestion of exercise and that of errors in diet, drink and sexuality, and finally the use of light and loose sleeping apparel and bed-clothing, all remove sources of reflex disturbance and irritation, and with these the tendency to partial or complete erection. It is alleviated by hot baths applied to the penis and hips as decongestants and sometimes by the ice-bag when heat fails. Of service are the opium suppository, grain  $\frac{1}{2}$  to 1, before retiring, and anodynes, such as the bromide of camphor, grains 10 to 15, at night, or smaller doses three times daily; codein, grains  $\frac{1}{2}$  to 1, before bedtime, or less at regular diurnal intervals, and the bromide of soda and bromide of potash, grains 10 to 20 each, an hour before bedtime. Antipyrin, with or without opium products, both in moderation, are recommended such as:

R—Antipyrine . . . . . 0.2 to 0.3 gramme (3 to 5 grains)  
 Codein sulphate . . . . . 0.016 to 0.032 gramme (grains  $\frac{1}{4}$  to  $\frac{1}{2}$ )  
 Mix, make one pill and mark:

One pill three times a day or two or three pills before retiring.

R—Bromide of potash . . . . . 1.0 gramme (15 grains)  
 Bromide of soda . . . . . 1 gramme (15 grains)  
 Distilled water up to . . . . . 8 c.c. ( 2 drams)

Mix, make a solution and mark:

Two teaspoonfuls at night before retiring or one three times a day in a half-glass of water, two hours after eating.

Phenacetin in doses of 0.3 to 0.6 gramme (grains 5 to 10), once or twice a day, is a good anodyne and circulatory sedative, and the author has had excellent results in sthenic patients, with tablet triturates containing from  $\frac{1}{4}$  to 1 minim of fluidextract of aconite, every one or two hours, until the slightest sign of physiological action, as sweating, relaxation or tickling of the finger-tips or tongue appears or until three or four doses have been taken. Inhibition of the erection is sometimes possible by grasping the thighs near the groin over the adductor muscles in which the crural branch of the genitocrural nerve lies until slight pain is produced. Thus inhibitory impulses are set up in the genital branch, which often checks the erection at its very onset.

The discharge in the acute period is left alone locally in the expectant treatment until the severity of the symptoms begins to decline, but

is influenced, of course, by the general management and methods just described. Therefore the local measures against this symptom are noted in later paragraphs.

Systemic subjective symptoms have been listed elsewhere (page 34), as anorexia, constipation, anemia, depression, prostration, chilliness, fever and insomnia, varying in severity so that in mild cases they are hardly discernible. Anorexia, constipation and anemia are all benefited by good diet and rhubarb and soda mixture (U. S. P.) in 1 to 2 teaspoonful doses three times a day. The soda is of benefit to the acid urine, but the rhubarb may irritate the inflammation. In such event simple bitters or digestants and cathartics are required. This old-time remedy is a good corrigent of the digestive disturbance of many of the other medicines required by the symptoms. Depression and prostration call for moral assurance, establishment of confidence of relief and either mild stimulation, with strychnin, for example, or sedation with bromides. Chilliness and fever suggest rest in bed, evacuation of the bowels, opening of the skin, light diet and Dover's powder, grains 5 to 10, at night, and insomnia is reached with the hot or cold bath and very mild hypnotics, of which none is to be preferred to increase of the bromides, perhaps already being administered for the pain and chordée.

Overmedication may easily ensue upon too much attention to these subjective symptoms, which commonly last a few days at the most and disappear under nature's own processes. Intense infection, however, may require great judgment in these as well as other particulars.

Objective local symptoms have been detailed in other pages as redness, edema and infiltration of the meatus, foreskin and urethra, lymphangitis and discharge. Redness and edema are not preventable, but greatly benefited by cleanliness and all the measures previously described for the pain and congestion. Lesions of the foreskin may be prevented by prophylactic measures of cleanliness and antiseptic washing. Lymphangitis and lymphadenitis commonly rest on lesions of the foreskin, such as phimosis, paraphimosis, excoriating balanoposthitis and the pocketing of pus. Soap and water and antiseptic cleansing are preventives if the foreskin is retractable, followed by the application of drying powders, of which none are better than various combinations of thymol iodid, boric acid and bismuth subgallate. If the foreskin is not retractable, then subpreputial irrigations as described on pages 86 and 97, under the complication phimosis and hand injections of mild antiseptics are indicated. Tincture of iodine painted lightly over the inflamed trunks and glands is of service if applied in the morning, as in the evening the irritation may cause wakefulness.

Discharge is so largely a local condition that it is hardly influenced directly by internal medication. The urinary antiseptics, therefore, largely fail against the gonococcus because the organism is beneath the surface of the mucosa, where it does its harm and from which it is cast off by the exfoliation of epithelia and the diapedesis of leukocytes in the formation of pus. These urinary cleansing agents are available only in the kidneys, where the pus is present at the point of secretion

of the urine or in the pelves of the kidneys and the bladder, where for a relatively long time they are in contact with the infecting organisms, but in the urethra the outflow of urine is so brief that the contact between the two is insufficient. The following are the antiseptics usually employed:

R—Hexamethylenamin . . . . . 0.5 gramme (7.5 grains)  
 Alone or combined with  
   Sodium benzoate . . . . . 0.5 gramme (7.5 grains)  
   Distilled water up to . . . . . 4.0 grammes (1 dram)  
 Mix, make a solution and mark:  
 One teaspoonful in a half-glass of water every four hours or three times a day, two hours after eating.

The benzoate of soda is an adjuvant of the germicidal action and a corrigent of the irritating action of the hexamethylenamin.

R—Salol . . . . . 0.3 gramme (5 grains)  
 Mark: One tablet or powder with a glassful of water every four hours.  
  
 R—Sodium salicylate . . . . . 0.3 gramme (5 grains)  
   Distilled water up to . . . . . 4.0 grammes (1 dram)  
 Mix, make a solution and mark:  
 One teaspoonful in a half-glass of water every four hours or three times a day, two hours after eating  
 Benzoate of soda or salol may be added, either or both, if desired.

The stage of decline is marked by definite subjective relief and objective improvement in all symptoms, especially that of the urine in the multiple-glass tests. In a word, it is the time of progressing quiescence and beginning control of the infection by nature's own processes. It is also the preferred period for instituting local treatment of the urethra as a diseased anatomical entity.

The local measures are either hand injections, office irrigations or both combined and are employed in the urethra only in the declining stage, when both the suffering and the pus are definitely less active, which means toward the end of the second to the third week in mild cases and of the third to the fifth week in severe cases. It is the symptoms and not the elapsed time which determine, and there must be fewer gonococci, pus and exfoliated epithelial cells under the microscope, and glass 1 of urine must be less densely turbid and glass 2 clear or nearly clear respectively in the mild and marked cases.

The methods are, as stated, three: (1) Hand injections, by which the patient with a small syringe medicates his own urethra; (2) irrigations, with catheter and bladder syringe, by which the physician from behind forward flushes the urethra; and (3) both hand injections and irrigations combined, because it is rarely possible to have the patient call with sufficient frequency to have the irrigation alone of terminal value. The local action is antiseptic, astringent and stimulating, which succeed each other as the case progresses, so as to correspond with the periods of infection with gonococci numerous, then that of declining symptoms and mucopurulence, with fewer or absent

cocci, and finally that of more or less indolent mucous discharge, tituting the terminal period and requiring stimulation for cure. The cations are therefore: (1) To interfere with and depreciate least ure's own processes of repair during all periods of the disease; (2) promote and stimulate most Nature's defensive properties against organisms and their toxins; and (3) to determine the limits of official influence of treatment as to the disease process as a whole. These three elements may be met then rational treatment will be the lt.



12.—Anterior irrigation. The patient holds the basin and his penis while net-Frank syringe rests on the basin and is connected with the catheter passed into ethra to the desired distance and held from slipping by the forceps. The layer of thrown over the penis and catheter prevents all splash and spatter and conducts turn flow into the basin. (Original.)

and injections have very definite restrictions and service. The ninary instructions are contained in the following rules in the or's article published elsewhere:<sup>1</sup>

st, always urinate before taking the injection, in order to wash ich pus from the urethra as possible.

ond, never use force in taking the injections, but rather, on the ary, be as gentle as possible.

rd, never use a syringe that does not work smoothly, because cking" syringe prevents gentleness.

<sup>1</sup> Pedersen, V. C.: Instruction on Gonorrhea, loc. cit.

*Fourth*, never use more than one syringeful at one injection unless specially ordered by the doctor.

*Fifth*, fill the syringe, hold it tightly against the mouth of the patient and gently fill the passage until it feels as full as it does when urinating, passing through it. In other words, no pressure greater than Nature's own during the act of urination is either necessary or desirable.

*Sixth*, hold the injection in five or ten minutes by the watch (time to be specified by the physician).



FIG. 13.—Anterior instillation. The patient holds the basin beneath and frees the penis, which rests against the scrotum. The hands of the operator support the penis and catheter, with the forceps against slipping during the instillation. (Original.)

*Seventh*, after cure, never loan the syringe to anyone else but rather destroy it in order to avoid poisoning anybody with it.

*Eighth* (omitted from the article quoted), begin with one or two injections a day as directed by the doctor and do not increase the number of injections without his knowledge or orders.

These eight simple rules should be printed on a slip of paper and handed to the patient, with suitable explanations and injunctions. The proper time for beginning this treatment is at hand. If they are included in the original circular of instruction many patients of "old and previous dispositions" begin to use the hand injections too soon and then blame the physician for the results which they themselves invite by such self-treatment.

The special syringe insisted on by the author is depicted in Fig. 61. Its size is so small (2 drams) that too much fluid cannot be injected into the average urethra. Its all-glass construction renders it sterilizable by boiling and its wooden container is a prophylactic against contaminating pockets and their contents or other utensils on shelves besides the syringe.

The limit of injections is to the anterior urethra alone so far as possible. Hence the patient should understand that his disease is located in the anterior urethra which alone should be injected with the medicine and that this result is obtainable by the use of small quantities and great gentleness, leaving Nature to carry the fluid along the mucosa as she will by capillary attraction between the walls which are in apposition. He should also comprehend that forcible injection traumatizes and irritates the mucosa and extends the infection. His "frenzy for quick cure" should be quieted in every possible way.

The frequency of injections in the author's practice is at first twice a day for one or two days, then three times, and by slow increase finally six times a day—in other words, about every two or three hours of the waking period or, what is usually the same thing, after each urination unless there are contraindications. Office catheter-and-syringe irrigations are given properly balanced between these hand injections. Each irrigation is regarded as supplanting one hand injection. If therefore the patient is taking four injections at home and one office irrigation these measures are regarded as the equivalent of five similar treatments in a day. If more than one office irrigation is desirable, for example, one each night and morning, then the patient omits the hand injection for the corresponding time. This is important especially when the activity of treatment is decreased, otherwise over-treatment with all its disadvantages will result.

The retention of injections for five to ten minutes augments the germicidal function of the injection by bringing the antiseptic into prolonged contact with the organisms as they lie upon the epithelia and by permitting it to soak into and between the epithelia, where they lurk, and also fulfils the indication of persistent gentle action exactly like that of the protective faculties of the blood, which are chemically not strong but act persistently. The urethra may be closed by the fingers of the patient or by use of one or other of the various urethral clamps, of which one of the best is that of Chetwood.<sup>1</sup>

On these points Taylor<sup>2</sup> has the following apt dictum: "It is a good rule to begin with the slow injection of about 1 dram of fluid, and then to increase as the tolerance of the urethra will admit, until a syringe-ful can be thrown into the canal without any resistance whatever. In this way the urethra becomes accustomed to the operation, and its walls can be well acted upon by the medicated fluid."

In the technic the first step is to evacuate the bladder, cleansing the urethra. The patient rolls his shirt to his armpits and his trousers

<sup>1</sup> *Practice of Urology*, 1913, p. 17.

<sup>2</sup> *Loc. cit.*, p. 62.



and drawers to his knees and protects the latter with paper or towels from leakage, as many of the valuable drugs stain. He should also cover the utensils used. He stands over a basin or urinal of a water-closet, with his legs conveniently separated, on the edge of a chair with a receptacle on the floor or sits fast on a toilet seat—all so that leakage may be received. The penis is grasped between the fourth and fifth fingers and the palm, leaving the thumb, index and middle finger to manage the glans and urethra. A smoothly working cone-point syringe is pressed into the urethra watertight, aided by the thumb and forefinger; which first opens the canal and then close it against the tip of the syringe. The direction of the instrument for outflow and the pressure against leakage must



FIG. 14.—Irrigation for the anterior urethral glass in the author's seven-glass test (original). After standard drapery (Fig. 15) a large sterile glass is held by the left hand, the upper end of the Wolbarst basin. The left hand supports the catheter within the glass. The right hand makes the Janet-Frank syringe and the outflow is conducted by the course of the catheter into the glass as shown. The author's seven-glass test is fully described on page 65 in Chapter VIII, on General Principles of Diagnosis.

acquired only with practice, as few patients have the knack of it. Gentle slow pressure to fill the urethra exactly as it is during micturition without pain or discomfort is the next step followed by the detail of retaining the fluid for five or ten minutes actual time "on watch" by closing the canal with the finger or a clamp.

Catheter irrigations constitute the office treatment as soon as hand injections have been ordered and therefore begin with the declining period of symptoms and organisms. The instrument used is a 150 c.c. Janet-Frank or equivalent syringe and a reflux, size 12, French soft-rubber catheter, illustrated in Fig. 14, or a short velvet-eyed rubber catheter, size 10, French, a suitable graduate for mixing the injection and the necessary towels and other dressings. The line of the irrigation is to the anterior urethra exactly as that of the

injection, because the disease is at least, so far as the infection is concerned, confined to the anterior urethra, although the posterior portion may have a sympathetic congestion without symptoms.

In good technic the patient always urinates in the presence of the urologist, cleansing the urethra as a preliminary, and then standing with his clothing adjusted exactly as for the hand injection, and preferably reclining on a couch or operating table, with the Wolbarst basin or other receptacle between his separated thighs, is ready. The urologist passes the catheter for only three or four inches, or until he feels the slight resistance of the bulb of the urethra, and then attaches the previously filled syringe. Two or three small pieces of gauze are laid over the glans and catheter loosely, so that the penis may be held and the catheter retained with the fingers without infection of the



FIG. 15.—Standard drapery in the reclining position (original). The patient is on an operating table, with leggings (Fig. 193) up to the groins and the Wolbarst basin between thighs. The author's perforated towel (Fig. 196) is passed over the penis so that its short end covers the upper portion of the basin for antisepsis, and its long end covers the abdomen.

and, and next with great gentleness and with no further distention on the urine itself makes, the urologist slowly irrigates the canal for about five minutes—thus fulfilling the indications of mechanical cleansing, gentleness without irritation and prolonged influence of the antiseptic or astringent. The fluid should be warm or comfortably

The standard drapery of the patient differs in the reclining and the standing positions for the various methods of treatment. In the reclining posture the patient is on his back on a suitable urological table, with his shirt rolled up to his arm-pits in front and behind and his trousers and drawers rolled down to his knees, or if prolonged irrigation is to be done they had best be removed and the leggings shown in Fig. 193 (page 721) put on in their stead. The warmed Wolbarst basin is placed between the thighs, and then the perforated towel detailed in Fig. 727 is passed over the penis, with the long portion

upon the chest and the short part between the penis and the basin for cleanliness and elegance. Any treatment whatever may now be developed without soiling the patient's clothing, because the basin and draperies receive all splash. If instrumental treatment is to be performed the basin is not used except with the author's irrigating sounds, when it is placed in position during the period of washing just at the knees to correspond with the outlet of the sound. If the Wolbarst basin is not at hand a douche-pan may rest beneath the patient's hips and well down toward the knees, or the return flow may be received into the douche-pan of the urological table, as usually provided. In the standard posture the clothing is arranged in exactly the same way and the perforated towel is used with the long part over the thighs and the short portion held by the patient over the abdomen. Another towel is spread over the edge of the basin or sink in the office, against which the patient leans or the hand basin may be held as shown in Fig. 13. These basins are readily sterilized, so that an experienced patient and a skilful operator make the towels unnecessary.

Fluids for hand injections and irrigations should always be selected with reference to heat and the avoidance of overaction. The object of freeing the surface of clinging pus, of mild penetration of the medicine, with hyperemia rather than irritation, must be borne in mind, and when in doubt weaker solutions and less active agents must first be tried and strength and action augmented by graduated steps. The following list is suggestive:

Argyrol . . . . .	3 to 10 per cent.
Protargol . . . . .	$\frac{1}{2}$ to 1 per cent.

These newer silver salts have stood the test of years with decided satisfaction. The former is rather the more commonly used because much the less irritating. For reasons unknown both these salts are of value in the body in controlling the infection and its results, although in the laboratory their germicidal power is very little. They probably act in three ways: (1) By penetrating the diseased epithelia they hasten its exfoliation, (2) by entering between the epithelia they destroy the gonococci and (3) by causing hyperemia aid both these processes on Nature's part.

When these silver salts are not tolerated or not available or when additional measures are indicated, the following solutions are advised:

Normal salt solution . . . . .	0.6 per cent.
Boric acid water . . . . .	2 to 4 per cent.
Liquor plumbi subacetatis . . . . .	half to full strength (U. S. P.)
Potassium permanganate solution . . . . .	1 in 8000 to 1 in 4000
Sulphate of zinc solution . . . . .	1 in 500 to 1 in 250
Alum solution . . . . .	1 in 500 to 1 in 250
Sulphate of copper solution . . . . .	1 in 10000 to 1 in 2000
Chloride of zinc solution . . . . .	1 in 10000 to 1 in 2000
Nitrate of silver solution . . . . .	1 in 10000 to 1 in 1000

In general the concentration is from 0.5 to 1 per cent. for all the weaker salts and a tenth part or a twentieth part of these strengths for the three stronger solutions headed by nitrate of silver, at the bottom of the list and including potassium permanganate. The normal salt, boric acid and weak lead-water are mechanical cleansing agents, while the potassium permanganate is one of the best antiseptics and astringents, followed by the other salts, which are valuable chiefly for their astringency and stimulus of the mucosa in the strengths commonly used. Thus the list presents the order of choice from the onset of local treatment in the early decline to its cessation in the terminal weeks.

Formulas for hand injections and irrigations are chiefly combinations of the foregoing solutions and should be applied according to the rules already detailed. The following examples are very valuable, similarly prepared and marked:

<b>R</b> —Zinc acetate . . . . .	0.75 grammes (grains 12)
Liquor of lead subacetate . . . . .	4.0 grammes (dram 1)
Distilled water up to . . . . .	180.0 grammes (ounces 6)
<b>R</b> —Sulphate of zinc . . . . .	0.375-0.475 gramme (grains 6 to 8)
Magendie's solution of morphin . . . . .	8.0 grammes (drams 2)
Distilled water up to . . . . .	120 grammes (ounces 4)
<b>R</b> —Zinc sulphate . . . . .	
Lead acetate . . . . .	of each 0.375 to 0.75 grammes (grains 6 to 12)
Distilled water . . . . .	up to 180 grammes (ounces 6)
<b>R</b> —Potassium permanganate . . . . .	0.03125 gramme (grain $\frac{1}{4}$ )
Distilled water . . . . .	180 grammes (ounces 6)
<b>Mix, make a solution and mark:</b>	
<b>External use as a hand injection from three to six times daily as directed.</b>	

*Internal Measures.*—During the period of decline with its local treatment neutralization of the urine is a much less important indication than soothing the mucosa and stimulating it to a more normal secretion. The varieties of drug are the blennorrhetic oils and oleoresins, the anodynes and sedatives and finally the urinary antiseptics—separately but more commonly combined in prescriptions.

The oils preferred are sandalwood, cubeb, turpentine, wintergreen and olive oil, which are administered in soft, soluble capsules, containing from 5 to 10 minims each, three times daily, so that the patient by slow increase receives from 15 to 60 minims in the twenty-four hours. The chief cautions are not to disturb the digestion, evidenced by eructations, or the kidneys, suggested by dull, dragging distress in the renal zone. Some patients break out in violent rashes after these medicines. The oil of wintergreen is of service when rheumatic signs begin to appear.

The oleoresins are copaiba, cubeb and matico, but for many digestions are less readily assimilable. Formulas combining the oils with each other and with the oleoresins follow. For patients who cannot afford these refined medicines, and when they are not readily and

consistently obtainable, the so-called copaiba compound ("*Lafayette mixture*") is advised:

R—Copaiba . . . . .	0.5 gramme (minims 8)
Spirit of nitrous ether . . . . .	0.5 gramme (minims 8)
Compound tincture of lavender . . . . .	0.8 gramme (minims 10)
Liquor of potassium hydroxide . . . . .	0.13 gramme (minims 20)
Tragacanth . . . . .	sufficient
Distilled water up to . . . . .	4.0 gramme (dram 1)

Mix, make a solution and mark:

One teaspoonful three times a day, with a glass of water, two hours after eating.

R—Copaiba . . . . .	0.25 gramme (minims 4)
Oil cubeb . . . . .	0.125 gramme (minims 2)
Oil turpentine . . . . .	0.25 gramme (minims 4)

R—Copaiba . . . . .	0.4375 gramme (minims 7)
Oil cubeb . . . . .	0.1875 gramme (minims 3)

R—Copaiba . . . . .	0.4375 gramme (minims 7)
Oil santal . . . . .	0.1875 gramme (minims 3)

R—Copaiba . . . . .	0.4375 gramme (minims 7)
Oleoresin cubeb . . . . .	0.125 gramme (minims 2)
Extract of buchu . . . . .	0.125 gramme (grains 2)

R—Copaiba . . . . .	0.375 gramme (minims 6)
Tincture ferric chloride (equivalent) . . . . .	0.125 gramme (minims 2)
Oleoresin cubeb . . . . .	0.125 gramme (minims 2)

R—Copaiba . . . . .	0.1875 gramme (minims 3)
Oleoresin cubeb . . . . .	0.1875 gramme (minims 3)
Oleoresin matico . . . . .	0.0625 gramme (minims 1)
Oil santal . . . . .	0.1875 gramme (minims 3)

R—Copaiba . . . . .	0.375 gramme (minims 6)
Oil cubeb . . . . .	0.125 gramme (minims 2)
Oil santal . . . . .	0.125 gramme (minims 2)

The urinary antiseptics are usually given alone in tablet or powder form, but preferably in solution and choice seems to remain with hexamethylenamin, grains 5 to 7½, salol, grains 5 to 10, sodium benzoate, grains 5 to 10, sodium salicylate, grains 5 to 10, and sodium biborate, grains 5 to 15, acid phosphate of soda, grains 5 to 20—dissolved in 1 or 2 drams of water, and taken three times a day, two hours after eating. The benzoate of soda is advantageously combined with the formaldehyde preparations, of which hexamethylenamin is the most reliable, and both drugs are employed in equal quantities to the teaspoonful dose, grains 5, 7½ or 10. Good combinations of the blennorrhetics and urinary antiseptics are the following two formulas for soft soluble capsules, of which one is to be taken three times a day, two hours after eating:

R—Salol . . . . .	0.228 gramme (grains 3.5)
Copaiba . . . . .	0.625 gramme (minims 10)
Oleoresin of cubeb . . . . .	0.3125 gramme (minims 5)
Pepsin . . . . .	0.0625 gramme (grain 1)

R—Salol . . . . .	0.25 gramme (grains 4)
Oleoresin of cubeb . . . . .	0.3125 gramme (minims 5)
Pepsin . . . . .	0.0625 gramme (grain 1)
Oil of sandalwood . . . . .	0.3125 gramme (minims 5)
Olive oil . . . . .	0.3125 gramme (minims 5)

The sedatives and anodynes are invariably given alone for incidentally severe symptoms which last at the most a few days, as a rule, or even less, and therefore contraindicate continued administration in these compounds. A sufficient number have already been named under the subject of Chordée.

The disadvantages of the internal medication are that all the oils, oleoresins and urinary antiseptics have a more or less disturbing influence on digestion, especially if taken too soon after eating. The proper interval is about two hours after the meal, when the stomach is about to empty itself. Many also irritate the kidneys, especially the antiseptics, which may cause renal hematuria, and the oils, characterized by lumbar discomfort, if not pain. And finally the oils and oleoresins cause rashes of the skin, of almost alarming severity, resembling scarlet fever. All these incidents indicate temporary cessation and thereafter alternation to avoid a return of these symptoms.

*Stage of Termination.*—In the last period of the disease the subjective symptoms are little or absent and the objective signs show the discharge thin and scanty or absent, except for shreds in the urine, so that glass 1 is clear, with shreds or slightly turbid with mucus, which contains shreds, and glass 2 is clear, with no shreds or a very few. The lesion is therefore catarrhal rather than suppurative, although pus under the microscope may still occur. The incidence of the catarrh is difficult to explain to many patients who cannot comprehend that catarrh is both the preliminary manifestation before the pus appears and the terminal manifestation after the pus disappears. Often patients will seek the services of another practitioner because they regard the terminal catarrh as a new disease, which incompetence has rendered possible.

Local measures are the hand injections, irrigations and instillations, employing by preference only astringent and stimulating rather than purely antiseptic combinations.

The hand injections are the same as those recommended for the earlier declining period, but weaker strengths, so that quarter-strength or half-strength solutions are employed of the newer silver salts, when germicidal influence is still called for, and of the zinc and alum formulas as corrigents of the silver nitrate combinations. This last drug is the best of all in this period.

The irrigations, with the same equipment as described on page 64, are begun with silver nitrate solutions, 1 in 10,000, gradually increased to 1 in 1000, employing from 100 to 150 c.c. at one treatment, with the reflux catheter to confine the application to the anterior urethra. Irritation from the nitrate of silver indicates dividing the given strength into halves and also decreasing the frequency, which, according to the response, is every other day, until fluid pus disappears. Then both the hand injections and the irrigations are discontinued. The slightest tendency toward persistence of shreds after a short period of rest foretells chronicity and requires the next step in treatment.

*Instillations.*—The small, 4-dram instillation syringe of Hayden (Fig. 7-F), with the short, velvet-eye soft-rubber catheter, size 10 or 12, French,

cannot be improved as instruments, because the syringe is so small that undue quantity of fluid cannot be employed and the catheter is both too short and too thin to extend the fluid beyond the anterior urethra or prevent it from escaping at the meatus. The strengths of silver nitrate solution employed gradually increase from the lowest to the highest, with recessions to weaker solutions should any be found to cause irritation.

The percentages recommended are as follow:

1 to 5000	1 to 2000	1 to 750	1 to 125
1 to 4000	1 to 1500	1 to 500	2 to 100
1 to 3000	1 to 1000	1 to 250	5 to 100

The frequency is every other day, with, as a rule, one ascent in strength at each visit until about 1 in 1000 is reached, because the higher concentrations are liable to irritate so that the increase must be much more slow. The quantity is 1 to 2 drams except the 2 in 100 and 5 in 100, of which only a few drops may be employed at points of soreness complained of by the patient. Force is reduced to great gentleness, so that the fluid runs in and out along the catheter, and retention, while the patient counts thirty slowly, of the last dram or half-dram, is a good rule and accomplished by having him squeeze the meatus shut while the catheter is slowly withdrawn. With scientific observation of the progress of the disease by stages, accompanied by judicious progress in the treatment, very frequently no true chronic stage with prolonged and variable symptoms and perhaps with absorption ensues.

Internal measures duplicate those for the previous period, with the tendency to decrease quantities and frequencies and to substitute tonic measures. Full diet without high seasoning and alcohol and moderate exercise are permissible. Sexual excitement, direct and indirect and with or without intercourse, is forbidden through the treble risk of relapse or reinfection of the patient or transmission of the disease to the woman.

**Aftertreatment.** When all symptoms have disappeared and active measures have been abandoned, a short period of aftercare is necessary for the severe cases. This involves a few weekly visits in order to be sure that signs of disease do not appear without attracting the attention of the patient and in order to build up the patient should his illness have depreciated his physical and nervous state.

All normal habits of life are slowly resumed. After treatment is stopped a month or two of observation and frequent tests must all show absence of the gonococcus and then cure is pronounced.

**Irrigation Method.** -*Definition.*- A local antiseptic attack against the infection is the predominant feature of the irrigation treatment irrespective of the various stages of the disease and, to less extent, of the various internal and other local measures, such as hand injections. For this reason, whether the patient is seen first in the invasion, early or late establishment or declining period, the washings of the urethra are begun, but are always graduated carefully in accordance with the response.

*Purposes.*—All comprise prevention of possible infection within a few hours of suspicious coitus, as discussed in the general topic of Prophylaxis (page 483), and of inoculation with instruments of any part of the urethra *de novo* or by passage through an infected to a healthy portion, and likewise include actual cure of infection recently or remotely established.

*Internal Measures.*—Internal measures are the same as those employed in the conservative method and are varied according to the stages, so that early dilution and neutralization of the urine are sought and later soothing and stimulation of the urethral mucosa. No further discussion of the means and formulæ employed is necessary beyond that just given in the previous paragraph.

*Local Measures.*—Local measures are comprised in urethral irrigations of three kinds: (1) syringe and catheter method, already fully described, which is rarely extended to the activity implied in the irrigation treatment, but is commonly restricted to correlation with hand injections; (2) the Janet method devised by Janet<sup>1</sup> in 1892, but modified by Valentine and Swinburne chiefly in the details of nozzles, cutoffs and reservoirs; (3) the Chetwood double current method.

*Janet-Valentine<sup>2</sup> method* requires as its equipment a wall bracket with pulleys, over which runs a chain or cord suspending a glass reservoir, with conical bottom, attaching a long rubber hose leading to a special cut-off and shield, and which receives one of four varieties of glass tip, respectively for the normal, large or small male and the female urethra. The patient's preparation involves adjustment of the clothing, with the shirts rolled to the breasts and the trousers dropped to the knees. He may assume sitting, reclining or standing posture, having the following details: The sitting posture is with the sacrum at the edge and the shoulders upon the back of a strong chair and the feet on the floor. The reclining position involves the ordinary operating table and the standing attitude is in front of a sink or other fixture. Towels or an apron protect the clothing from splash and a scalded and cleansed receptacle, by preference the Wolbarst basin, is placed between the thighs, with the penis over its edge, so that the return flow is readily received into it. A bed-pan or Kelly pad may be used instead under the patient on an operating table, but usually soils the buttocks so that the basin is much preferred.

The technic begins and ends with sterilized utensils and instruments and requires the urologist at the side of the patient. All surfaces of the penis, foreskin and glans are cleansed with antiseptic wash and cotton swabs or with the irrigating fluid played first over the organ, and then in order over the foreskin and glans, with its folds and sulci, and finally the meatus held open by digital pressure. The stream is next turned into the urethra by holding the nozzle against the meatus tightly enough to permit inflow, but not to exclude outflow, which is immediately favored by slight withdrawal as soon as the urethra seems

<sup>1</sup> Ann. de dermat. et de syph., 1893, iv, 1016.

<sup>2</sup> Irrigation Treatment of Gonorrhea, its Local Complications and Sequelæ, 1913.



distended. Force is determined by the height of the irrigator above the patient's head, and should be sufficient to fill but not strongly dilate the canal, and always without pain, bleeding or other irritation. The author believes that the margin of safety requires a pressure only equal to that of the urine, and therefore does not elevate the reservoir above the patient's ear. Duration of from five to ten minutes is usually sufficient, although the longer the irrigation the better if gentleness and relative dilution of the fluid are observed. Temperature is within tolerance and ranges from 105° to 120° F. without secondary irritation. The greater the heat well borne the higher the astringency and antiseptic value, as a rule. Limitation of the irrigation to the anterior urethra is recommended by Valentine<sup>1</sup> in the special method of holding the shaft of the penis and urethra in the third, fourth and fifth fingers, which are released, one at a time, as the fluid reaches it, until finally it passes to the bulb. Frequency is outlined by the following table of Valentine, modified from Janet, containing allusion to intravesical irrigations discussed under this form of treatment of posterior urethritis.

First day, first visit	Anterior irrigation . . . . .	1 to 3000
First day, 7 P.M.	Anterior irrigation . . . . .	1 to 4000
Second day, 9 A.M.	Anterior irrigation . . . . .	1 to 3000
Second day, 7 P.M.	Anterior irrigation . . . . .	1 to 4000
Third day, 9 A.M.	Intravesical irrigation . . . . .	1 to 6000
Third day, 7 P.M.	Anterior irrigation . . . . .	1 to 5000
Fourth day, 9 A.M.	Intravesical irrigation . . . . .	1 to 5000
Fourth day, 7 P.M.	{ Intravesical irrigation . . . . .	1 to 5000
	{ Anterior irrigation . . . . .	1 to 2000
Fifth day, noon	Intravesical irrigation . . . . .	1 to 5000
Sixth day, noon	Intravesical irrigation . . . . .	1 to 5000
Seventh day, noon	Intravesical irrigation . . . . .	1 to 5000
Eighth day, 9 A.M.	{ Intravesical irrigation . . . . .	1 to 5000
	{ Anterior irrigation . . . . .	1 to 3000
Eighth day, 7 P.M.	{ Intravesical irrigation . . . . .	1 to 5000
	{ Anterior irrigation . . . . .	1 to 2000
Ninth day, 9 A.M.	{ Intravesical irrigation . . . . .	1 to 4000
	{ Anterior irrigation . . . . .	1 to 1000
Ninth day, 7 P.M.	{ Intravesical irrigation . . . . .	1 to 4000
	{ Anterior irrigation . . . . .	1 to 1000
Tenth day, 9 A.M.	{ Intravesical irrigation . . . . .	1 to 5000
	{ Anterior irrigation . . . . .	1 to 5000

The Chetwood<sup>2</sup> double current method also demands sterilized instruments and utensils, before and after, but has a somewhat different equipment in the bracket, pulleys, chain and jar, but chiefly in the double current, scissors handle, cut-off and Y-shaped glass nozzles adapted for the various sizes of meatus and urethra. The patient's preparation is exactly the same as just detailed, in the standing, sitting or reclining posture. Force is again limited to that of the normal urinary stream, in the author's opinion, and in his practice is detected by holding the penis against the palm of the hand, with the finger-tips over the urethra in order to feel the resistance. Discomfort or pain immediately requires lowering the irrigator even below the ear of the patient.

<sup>1</sup> Loc. cit., p. 18.

<sup>2</sup> Practice of Urology, 1913.

The technic consists in holding the correct size of nozzle water tight against the meatus, gently filling the canal to the bulb, and then by closing the scissors handle cut-off allowing the charge of fluid to escape into a receptacle. This process is alternately continued until the canal is suitably cleansed. All the other features are the same as in the Janet-Valentine method, especially preliminary washing of the organ, duration, temperature, limitation and frequency of the irrigation.

Solutions for irrigations do not depart in constituents or strengths from the formulas for hand injections, but may have fewer elements and much greater quantities. Stock solutions ready for dilution in varying strengths up to full concentration are convenient as follows:

R—Crude alum . . . . .	1 part
Zinc sulphate . . . . .	1 part
Distilled water up to . . . . .	500 parts
Mix, make a solution and dilute according to table.	
R—Permanganate of potash . . . . .	1 part
Distilled water up to . . . . .	500 parts
Mix, make a solution and dilute according to table.	
R—Nitrate of silver . . . . .	1 part
Distilled water up to . . . . .	500 parts
Mix, make a solution and dilute according to table.	

The first formula is chiefly astringent and the least active; the potassium permanganate adds antiseptics, with little astringency, while the silver nitrate possesses both actions in marked degree so that increases in strength should be slowest with it, but may be more rapid with the other two solutions, always according to reaction.

TABLE OF DILUTION OF STOCK SOLUTIONS.

Quantity of 1 to 500 stock.	Quantity of water.	Total irrigation.	Strength of irrigation.
3 c.c.	97 c.c.	100 c.c.	1 in 15,000 +
5 c.c.	95 c.c.	100 c.c.	1 in 10,000
10 c.c.	90 c.c.	100 c.c.	1 in 5,000
20 c.c.	80 c.c.	100 c.c.	1 in 2,500
30 c.c.	70 c.c.	100 c.c.	1 in 1,500
50 c.c.	50 c.c.	100 c.c.	1 in 1,000
100 c.c.	0 c.c.	100 c.c.	1 in 500

In the terminal stage of acute disease solutions stronger than 1 in 2500 or 1 in 1500 are rarely necessary. Resistance to these strengths foretells chronic conditions.

*Cure.*—Cure cannot be pronounced until the urine is clear of mucus, pus or shreds, and has remained so for a long time, and so continues in the presence of irritation by intentional errors of diet, the beer test and mildly irritating instillations. A few mucous shreds, with minimal pus, are allowed provided in any and all circumstances the gonococcus is absent, after repeated search by both smear and culture, through a month or more of examination. Further details are found in the paragraphs on Prophylaxis (page 483). Examination of the semen, secured

in a condom, worn at night, which soon stimulates an emission, must always be the last test. Absolute relief from the disease is present when there is no longer any infection and when all symptoms are absent and no chronic or complicating lesions appear.

#### POSTERIOR GONOCOCCAL ACUTE URETHRITIS.

**Significance.**—Extension of the organisms into the posterior urethra is a condition of great clinical importance, owing to the severity of the infection, which causes invasion beyond the compressor urethræ muscle into the posterior urethra and owing to the number and viciousness of the complications usually associated with it. A distinction must be drawn between real infection of the posterior urethra and a sympathetic congestion without infection, such as is probably common for a day or so in every case of severe true anterior urethritis. The former has a definite symptomatology, but the latter, only temporary urinary disturbance.

**Etiology.**—The etiology is the same in predisposing factors as in anterior disease and the exciting factor is the gonococcus, with or without other organisms. The extension into the deep urethra by the organisms, however, may be secured alone by the intensity of the infection or also by mechanical means, such as injections improperly or too frequently taken, irrigations too concentrated or forcible in application, instruments such as catheters and sounds prematurely passed, indirect traumatism of exercise or travel, and perhaps most common of all hypercongestion of sexual excitement and dietetic indiscretions.

**Symptoms.**—*Local Subjective Symptoms.*—These have their onset at the end of the first or second week of establishment of vicious anterior urethritis or later in the less severe cases, and show varieties of intensity from simple hyperemia to florid and complicated types. The chief symptoms are decreased discharge and increase of frequency of urination, followed by tenesmus and augmented pain during urination or seminal emission and terminal hematuria. The decreased discharge is due to temporary withdrawal of the blood from the anterior urethra to the new zone of disease, so that the exudate from the former is for a brief period less copious. The pollakiuria is due to the direct involvement of the mucosa around the neck of the bladder, and the tenesmus rests on the same basis, with still deeper penetration, followed by spasm of the sphincter vesicæ. Terminal hematuria is explained in the same manner, with ruptured capillaries and denuded epithelium added. Emissions of semen are much more frequent than in anterior urethritis, because the outlets of the ejaculatory ducts and the prostate are both more or less involved and their pain is caused by all the inflammatory conditions present.

*Systemic Subjective Symptoms.*—These are alike in kind as but more intense in degree than those in anterior infections—namely, anorexia, chills, fever, depression, prostration, and pallid, haggard, worried appearance. Nervous irritability is common.

*Local Objective Symptoms.*—All rest on the urinary and rectal examination. Every specimen of the two or multiple glass-test is turbid, owing to the fact that the pus now lies throughout the canal from sphincter to meatus and the urine of the first glass is insufficient to clear the urethra. Often the last glass is equally as or more turbid than the first glass, owing to the fact that the contraction of the posterior urethra in carrying the urine outward expresses more pus than the first flush of urine washes before it. The last glass may also contain prostatic elements for the same reason. Rectal examination must reach the prostate, seminal vesicles and ampullæ of the vasa deferentia as any or all these structures are involved at least in secondary congestion if not complicating infection. The former lesion may give an almost negative finding or merely softness, succulence and slight tenderness, with increased pus in the test-glass after manipulation. The sulcus of the prostate marking the general course of the urethra through it between the two lateral lobes is usually the point first and most affected. Infection of these structures belongs to the subject of Complications under which it is treated.

*Termination.*—Posterior gonococcal acute urethritis is very apt indeed to become chronic, especially in the marked cases, and therefore to have no stage of termination, strictly speaking. The mild cases, however, last a short time—one or two weeks—and then subside in much the same manner as anterior disease. Pollakiuria, tenesmus and terminal hematuria all gradually subside, likewise sexual excitement, with emissions. The discharge previously decreased in the anterior urethra lights up anew and the urine finally becomes clear except in the first glass, while shreds and slugs are in the second and later glasses derived from the posterior canal. Irrigation of the anterior urethra copiously may so cleanse the lining that all the glasses will be practically clear when the posterior lesion has fully recovered.

*Complications.*—Complications of posterior gonococcal acute urethritis are noted for their frequency and presence rather than for their rarity and absence, and almost always initiate lesions of chronic tendency, such as urethrocystitis, retention of urine, funiculitis, epididymo-orchitis, seminal vesiculitis and prostatitis. Less commonly the disease extends into the bladder and causes cystitis, ureteritis, pyelitis and pyelonephritis. Absorption of organisms and toxins leads to gonococcal endocarditis, synovitis, pleuritis and not commonly septicæmia. The occurrence of complications is due to the complexity and delicacy of the mucosa and its annexed glands and organs in both sexes and to the penetrating destructive characteristics of the gonococcus and its associated organisms. Variability of clinical features of all such complications requires their discussion in a separate chapter, devoted to the subject of Complications (Chapter II).

*Preventive and Abortive Treatment.*—Preventive and abortive treatments are in the strict sense impossible beyond careful and judicious measures applied to anterior urethritis. There is almost always at least a sympathetic congestion of the posterior urethra in every well-

established example of the anterior lesion, which leads to mild symptoms of brief duration, and in practically every severe urethritis the posterior canal becomes actively involved, usually within two weeks and sometimes a few days.

**Curative Treatment.—Conservative Method.—Stages.**—The usual four periods are noted. The incubation is really in the transit of the infection into the posterior segment of the canal, and is so masked by the anterior symptoms as to be indistinguishable, and hence beyond definite treatment. The invasion for the same reason is practically absent, although mild irritation about the neck of the bladder is a forewarning and may be regarded as marking this period; but by no means invariably because only sympathetic congestion and not infection may be present. Good management alone is the required treatment.

The details of management are described in full in Chapter IX, on the General Principles of Treatment (page 483.)

Local subjective symptoms, already stated in the clinical paragraphs, are temporarily decreased discharge, pollakiuria, dysuria and tenesmus, all due to irritation, and terminal hematuria and sexual emissions, both due to extreme congestion.

The irritation and congestion indicate cessation of blennorrhagics and stimulants and return to sedatives, diuretics and neutralizers such as:

R—Citrate of potash . . . . .	30 grammes (ounce 1)
Tincture of hyoscyamus . . . . .	8 to 12 grammes (drams 2 to 3)
Fluid extract of kava kava . . . . .	15 grammes (ounce $\frac{1}{2}$ )
Distilled water up to . . . . .	240 grammes (ounces 8)

Mix, make a solution and mark:

One tablespoonful in a half-glass of water two hours after eating and once during the night.

When vesical irritation is marked one may order:

R—Fluidextract of triticum repens . . . . .	45 grammes (ounces 1 $\frac{1}{2}$ )
Fluidextract of uva ursi . . . . .	45 grammes (ounces 1 $\frac{1}{2}$ )
Citrate of potash . . . . .	15 grammes (ounce $\frac{1}{2}$ )
Distilled water up to . . . . .	120 grammes (ounces 4)

Mix, make a solution and mark:

One to two teaspoonfuls in a half-glass of water two hours after eating and once during the night.

For cases with great pain and disturbance, the following is valuable:

R—Fluidextract of triticum repens . . . . .	45 grammes (ounces 1 $\frac{1}{2}$ )
Fluidextract of uva ursi . . . . .	45 grammes (ounces 1 $\frac{1}{2}$ )
Liquor of potash . . . . .	15 grammes (ounce $\frac{1}{2}$ )
Tincture of opium . . . . .	4 to 6 grammes (drams 1 to 2)
Distilled water up to . . . . .	120 grammes (ounces 4)

Mix, make a solution and mark:

One teaspoonful in a half-glass of water every three or four hours as needed, then three times a day, two hours after meals.

Systemic subjective and objective symptoms have been stated as intensifications of those in anterior conditions: Anorexia, chills, fever,

depression, prostration, nervous irritability, pallor and worry. Their treatment is along general lines of good management, diet and suitable support. Further details are unnecessary.

Local objective symptoms are the discharge figured in the pus in all glasses of the multiple glass test and the findings on rectal examination. Discharge as a subjective symptom properly belongs under this heading for its treatment. The question of local treatment in posterior acute urethritis may be answered as follows: If the disease has followed quickly upon anterior treatment it is well to regard the latter as causative through undue severity or frequency and posterior measures as unwise. If the posterior disease is present at the first visit or arises in the absence of anterior interference it may be regarded as a pathological extension and as an indication of properly selected treatment.

Local measures, as hand injections or syringe-and-catheter irrigations in the office, are in all cases to be discontinued, and peremptorily must be in severe cases. In mild attacks hand injections may be continued at greatly reduced strengths, but only by very intelligent patients, and the irrigations are preferably boric acid water or normal salt solution for the benefit of the heat. Hydrotherapy is highly advisable in the form of ice-bags to the perineum and pubic regions, and hot or cold rectal irrigations, with double current tubes, permitting the fluid to bathe the mucous membrane, or with the psychrophore, which applies the temperature only and not the water, or with simple enemata, which the patient takes in small quantities, holds as long as possible while straddling the toilet, and gently repeats several times at each sitting. Such enemata are least advisable, but must be used by patients who cannot afford the rectal tube or psychrophore. Normal salt solution at 105° to 120° F. is best to avoid irritating the rectal mucosa by any method.

Hot sitting and body baths increase the decongestion instituted by the rectal hydrotherapy. Opium suppositories, grain  $\frac{1}{2}$  to 1, may be judiciously used in the right type of patient for great pain, otherwise the formula with laudanum is used. Massage and electrotherapy are both contraindicated, but examination of the prostate is advisable every few days in order to detect its earliest involvement, through enlargement, tenderness, tension, edema and the like. Deep instillations of nitrate of silver solution, 1 in 1000 up to 1 in 500, may be applied through a 16 French soft-rubber catheter most gently passed into the prostatic portion. Tenesmus and bleeding may be alarming and severe. Only a few drops should be used, and not repeated unless benefit results. The weaker solution is the better for the first treatment.

*Stage of Decline.*—This period is as in anterior acute urethritis, that of Nature's success against the disease and the time of local treatment, and its management remains the same except that diet may be lightly increased and in the mild, uncomplicated cases the patients may go outdoors, but in the severe cases remain resting in easy chairs,

and in the complicated cases are still confined to bed. The ingestion of fluids is still allowed in slightly increasing quantities. Systemic administration is relied on to relieve all the systemic subjective symptoms and most of the local subjective symptoms. Such as are not reached by these methods are benefited by the treatment of the discharge. Blennorrhetics are again used for stimulant effect, but never to extremes, and always associated with urinary antiseptics as preventives of infection of the bladder by the irrigation of this viscus.

The local treatment is in the form of weak and then slowly increased formulas, previously given for hand injections, made first once or twice and then more frequently each day, and in the form of syringe-and-catheter irrigations, preferably in the reclining position, beginning with normal salt solution and boric acid water, then continuing with the milder antiseptics already detailed and ending with the stronger solutions. The urethra is first flushed by urination and then its anterior segment is thoroughly cleansed, and last a small soft-rubber catheter is very gently passed into the bladder, which is immediately thoroughly irrigated in order to prevent infection and left comfortably distended so that the patient washes his posterior urethra with the antiseptic fluid exactly as with urine. After further decline, and with a tendency to indolence, mild and ascending strengths of instillations are applied to the deep urethra, always without tenesmus resulting. Nitrate of silver is the choice in strengths from 1 to 10,000 or 1 in 5000, slowly increasing to 1 in 1000 or more cautiously 1 in 500. Failure with these measures forewarns of the chronic period, which is discussed in subsequent paragraphs.

*Stage of Termination.*—This period in uncomplicated cases under expectant treatment is reached in from a few days to two or three weeks, but in uncomplicated severe cases the chronic lesions appear and persist for weeks or even months. Complications always involve long continuation, and their presence is detected by rectal and urethral exploration, urethroscopy and cystoscopy, and their treatment belongs to subsequent paragraphs on each separate complication.

Complications are fully treated each under its own heading in Chapter II, pages 82 and 106.

Retention of urine may be classed either as a symptom or a complication, and should be mentioned here. It should be managed by absolute rest in bed, free evacuation of the bowels and very light fever diet. Systemically, morphin, with the needle or a Dover's powder by mouth or an opium suppository, in selected cases, is given as an antispasmodic and sedative, and locally heat as a decongestant is applied by urethral irrigations of boric acid water, and prolonged sitting and body baths and rectal irrigations almost always relieve, so that the patient may urinate into the bath water. Instrumentally a size 14, 16 or 18 French soft-rubber catheter may be passed with great gentleness, to avoid all spasm, and the bladder emptied, whole if moderately filled, but in part if much distended, in order to avoid passive hemorrhage from sudden release of pressure. With the

catheter in place the viscus must be irrigated to avoid infection, using potassium permanganate, 1 in 8000 to 1 in 4000, or nitrate of silver, 1 in 10,000 to 1 in 5000, or one of the newer silver salts, such as argyrol, 2 to 5 per cent. A little of the weak solution must be left in the bladder if the distention was marked, in order to avoid passive hemorrhage. The catheter is slowly withdrawn, and at the moment outflow ceases its eye is in the deep urethra, where a little nitrate of silver solution, 1 in 1000, may be deposited as a corrector of the edema. Prevention of relapse requires repetition of the Dover's powder or suppository, hot pack, baths, rectal irrigations and urethral irrigations, while prevention of onset rests with proper care of the posterior acute urethritis; but the retention may supervene notwithstanding every precaution and measure.

**Irrigation Method.**—*Cautions.*—Undue force of the irrigation may penetrate the crypts of the mucosa, the acini of the prostate with their ducts and the ejaculatory ducts, of which the majority face forward and all are minute and tender structures. Chemical inflammation and positive traumatism even to rupture, similar to the rupture of the urinary bladder by distention, may result, thus causing complications directly. Undue frequency, excessive concentration and idiosyncrasy of the patient to the solution may also cause secondary irritation and add to the inflammation. It is possible to do as much damage with a stream of irrigation as with an instrument—both unskillfully handled.

Definition, purposes and preliminaries are the same as in the irrigation method in the anterior urethra and vary from this only as to the site. It may be used as a preventive of infection after the passage of instruments, but is probably less advisable than the passing of a soft catheter for the purpose, and is much less convenient than the author's irrigating sounds and similar instruments, which permit the bladder to be filled at the one incursion and before withdrawal. The patient should always urinate in the presence of the surgeon before the irrigation.

Internal measures are the same as in anterior irrigation, with the detail that blennorrhetics are somewhat more reservedly employed.

Local measures are of three kinds: (1) syringe-and-catheter method, (2) Janet-Valentine method, (3) Chetwood double-current method. The application of each has the following restrictions:

Syringe-and-catheter posterior irrigation is undoubtedly the safest in the posterior urethra, and is defined by the passage of a catheter into the posterior urethra and bladder followed by irrigation of both parts. Its preliminaries are the standard preparation of the patient, complete sterilization of all instruments and utensils, evacuation of the bladder by the patient before passing the catheter and irrigation of the anterior canal before the posterior portion is invaded. Its equipment is an assortment of soft-rubber, velvet-eye or new smooth woven catheters, sizes 14, 16 and 18, French, a 150 c.c. Janet-Frank syringe (which is preferred to the irrigating jar), a Wolbarst or other basin



and assorted towels and similar dressings. Its technic is the passage of the catheter, cleansing the anterior urethra as it progresses and then without the fluid running the posterior urethra and bladder are entered so gently that no spasm occurs. The bladder is filled to comfort and evacuated several times and left filled at the last step. As the catheter is withdrawn the posterior urethra may receive instillations or mild irrigation if no spasm is present, and finally it is washed by having the patient pass the antiseptic fluid left in the bladder. Force is unnecessary beyond that for filling the bladder, and duration ends with several distentions of from 150 to 500 c.c. always within tolerance, and frequency is like that of anterior irrigation, at first daily, then every other day and finally temperature rests on comfort, but ranges from 100° to 120° F., by the thermometer. Fluids are the standard solutions and combinations already detailed.

Valentine-Janet posterior irrigation<sup>1</sup> in the prostatic urethra has the same equipment, preparation, preliminaries and postures as in the anterior treatment. Fully sterilized instruments, utensils and external organs and urination of the patient in the presence of the urologist are basic principles. Its technic requires position at the side of the patient, irrigation of the penis and external genitals and then tight apposition of the nozzle into the meatus, so that outflow is prevented. The force is slowly increased by raising the irrigator up to a head of six to eight feet as the urethra distends. While the patient breathes deeply and tries to urinate, the fluid is felt to start into the bladder by both the urologist and the patient. Then the force of the fluid should be decreased by pressure on the stopcock and checked before pain. The basin and nozzle are now removed and the patient's genitals dried. He then passes the contents of his bladder into test-glasses, either sitting or standing, at once or after waiting, according to the presence of infection in the bladder. Duration is only to fill the bladder with from 150 to 500 c.c., once or several times, according to the condition of the organ and irritation and tolerance. The latter increases with experience in the patient and gentleness in the urologist. Temperature rests on the same basis, varying from 100° to 120° F., by the thermometer. Frequency begins with once a day and then every other day, and at each treatment several distentions of the bladder are possible until the return flow is clear of pus, when a final distention is left for evacuation. Spasm is usually overcome by starting with a fully empty bladder, reducing the force of the stream, diverting attention of nervous patients and using the reclining position. The fluids are the duplicates of formulæ previously described.

Chetwood double-current posterior irrigation shows no changes in the deep urethra from that in the anterior portion as to all the preliminaries discussed under that subject. Sterilization of all instruments and utensils and passing of the urine in the urologist's office are axioms. Force from an elevation of the irrigator, six to eight feet, is necessary

<sup>1</sup> Loc. cit.

and the technic is the same as in the Valentine method, with the added advantage of the double current cut-off, with which the fluid is applied to the sphincter muscle until the bladder is filled with small quantities at first and then with larger supplies up to tolerance, and always with gentleness to avoid spasm. Final details, such as duration, temperature, frequency and repetitions, are the same as in the other procedures. There is no change from the standard fluids designated in earlier paragraphs.

*Aftertreatment* and *cure* are the same in posterior gonococcal acute urethritis as briefly noted under the heading of Anterior Gonococcal Acute Urethritis (page 70). Further note is therefore here unnecessary.

**Treatment of Nongonococcal Urethritis.**—The brevity of this subject in this work, owing to the fact that gonococcal urethritis is presented as the typical inflammation in all its phases, has made it advisable to consider the treatment of nongonococcal urethritis of both acute and chronic forms after the treatment of gonococcal chronic urethritis as part of Chapter IV.

## CHAPTER II.

### COMPLICATIONS AND SEQUELS OF ACUTE URETHRITIS.

**General Considerations.**—Anterior and posterior acute urethritis have acute complications which possess distinct tendency to become chronic, owing to the complexity and delicacy of the organs and the destructive and penetrating faculties of those organisms which commonly provoke the severe infections, notably the pyogenic and gonococcal forms, in pure or associated culture. On the other hand, complications may arise in any of the other nongonococcal urethritides in patients of lowered vitality and with intense invasion. Complications are also not uncommon in relapsing nongonococcal disease, such as catarrhal and diathetic, while they are very common indeed in relapsing gonococcal acute urethritis.

**General Clinical Features.**—In all acute complications of acute urethritis of any origin whatever the clinical characters are much the same according to the special part involved. Inasmuch, however, as gonococcal acute urethritis is most prone to develop the complications, and as their symptoms are the most typical and severe, it is best to regard them as the standard of comparison for the other forms. The best is the clinical classification into acute and chronic as to course, and anterior, posterior and anteroposterior as to location. The chronic complications belong to the subject of chronic urethritis, hence only the acute forms will be considered in this chapter.

#### I. COMPLICATIONS OF ANTERIOR GONOCOCCAL ACUTE URETHRITIS.

**Varieties.**—Two general subdivisions are recognized: (a) local, affecting the urogenital organs alone, and (b) systemic, affecting the body at large. In anterior acute disease systemic complications are rarely seen, are somewhat more common in posterior acute urethritis and still more usually occur in anteroposterior chronic urethritis. For this reason they will be discussed as essential to posterior lesions rather than anterior disease. The local complications had best be arranged in their anatomical order, and in the nature of things are only sexual and urinary in their location. They are: phimosis, paraphimosis, lymphangitis, lymphadenitis, littritis, folliculitis, cowperitis with retention and cowperitis without retention. Complications in the sexual, urinary or general systems arising cephalad to the triangular ligament are considered under posterior urethritis (pages 115, 201).

## A. UROGENITAL GROUP.

1. *Sexual Forms.*

## PHIMOSIS AND PARAPHIMOSIS.

**Definition and Etiology.**—Phimosis and paraphimosis are two complications which are caused by a long and a tight foreskin. Redundant prepuce leads to balanitis and balanoposthitis, while the tightness adds phimosis and irreducibility of a retracted tight prepuce causes paraphimosis. In all these three the inflammatory lesions are much the same.

**Symptoms.**—The subjective symptoms of phimosis are ardor urinæ within the cavity of the foreskin and not the course of the urethra, often



FIG. 16.—Method of reduction of reducible acute paraphimosis, showing position of foreskin and glans, respectively, within the grasp of the fingers and pressure of the thumbs. (Taylor.<sup>1</sup>)

with “ballooning” of the foreskin, due to back pressure during urination. Pain in the foreskin and glans is due to excoriation of the lining, retention and decomposition of urine, pressure of the edema, tension during erection and irritation by contact with clothing and fingers. Objective symptoms of phimosis are tenderness over the glans penis away from the course of the urethra, generalized over the whole glans and the foreskin and not localized as in chancrous phimosis. Retractable foreskin reveals a typical balanoposthitis, with redness, excoriation, maceration, edema and sometimes lymphangitis, everywhere distributed and a discharge which wells up from the recesses and folds about the corona and is therefore distinct from that which oozes from

<sup>1</sup> Loc. cit.

the urethra. Irretractible foreskin requires dilatation of the orifice and cavity with a three-blade nasal speculum and illumination with a urethroscopic lamp or examination with a Chetwood urethroscope and will show much the same features. The edema, as a rule, is localized to the foreskin and glans and not to the penis as a whole; occasionally, however, the edema is generalized throughout the penis and a large part of it. Lymphangitis may often be traced along the dorsal and sides of the organ into the groins, where lymphadenitis may be present, both with moderate tenderness.

Paraphimosis is regarded as of two varieties: acute reducible without gangrene, and acute irreducible or with gangrene. The reducible form is characterized by enormous infiltration of the foreskin with serum, so that it retracts beyond the glans and remains in that situation as a rather uniformly distributed mass of edema without pressure or necrosis. The irreducible type is characterized by a dense fibroelastic band of tissue, not uncommonly constituting the orifice or outlet of the redundant foreskin, which when passed beyond the glans is normally sufficiently tight to constrict, and to set up edema of the parts distal to it, and thereafter through the pressure of both the band and the edema to cause localized ulceration and gangrene. Rarely the death of the glans in part or whole is seen.

The objective symptoms are that the retracted foreskin constricts the corona. The pressure leads to congestion, lividity and edema of the glans and then of the constricting band. Ulceration, as a rule, occurs only in the foreskin at its tightest point, so that Nature's tendency is spontaneous division of the fibers and release of the glans. Retention of urine, except reflexly, does not occur. Beneath the folds of the foreskin, and especially within the pocket behind the constricting band, characteristic retention pus is secreted, produced by balanoposthitis. The characteristic organisms of this pus decide the nature of the infection.

The subjective symptoms are the pain due to the constriction, inflammation, and retained pus and fear through the unnatural, swelling, congestion, lividity and swelling of the glans.

**Diagnosis.**—Phimosis in its history presents the acute swelling of the irretractible foreskin which was previously retractible, and in chronic cases a foreskin which could never be reduced in which inflammation is persistent or acutely apparent. Paraphimosis in its history is never chronic, always acute, but may appear during a chronic urethritis with acute exacerbation. Subjective symptoms are chiefly those of the balanitis, posthitis and balanoposthitis, which are discussed under the next heading, and their origin in urethritis, ulcers or gonorrhea may sometimes be described by the patient. Objectively the condition of the foreskin and its lining is demonstrated by the palpation and inspection, with or without meatoscopes or urethroscopes, within the cavity of the foreskin, if irretractible. Laboratory findings are the most important and must demonstrate the gonococcus from within the urethra and the cavity of the foreskin recovered from the latter,

luminum loop and endoscopic tube, at points of maceration or lation of the modified skin. Other organisms causing this condition must be excluded.

importance of laboratory findings is most emphatic in all cases, more so in the extragenital complications, and must include in eriology smear, culture and animal inoculation and in hematology various fixation tests, of which two are recognized, syphilitic and coccal, with tuberculosis in the course of development and probably those of other diseases to be added later.



Fig. 17.—Author's case of phimosis due to advanced cardiorenal disease. This patient was in the last stages of cardiovascular and renal disease with marked edema of the lower extremities and the lower half of the abdomen. The penis was phimotic and the scrotum was enlarged by edema to three or four times its natural size. Marked balanoposthitis was absent. On account of obvious intraabdominal pressure and vascular atony the truss was not removed for the photograph.

diagnosis treatment must result in prompt relief of the balanitis independently of the urethritis. The following subjects will clear up the differential diagnosis: Chronic phimosis presents intermittent acute attacks, and finally the persistent or relapsing condition depending on anatomical defect or such diseases as diabetes. The symptoms are usually a thickened irreducible skin, with cracks and fissures

about the opening. The anatomical defect may be the only symptom in patients who have escaped inflammation within the foreskin.

**Treatment of Gonococcal Acute and Chronic Phimosis.**—Phimosis and paraphimosis are in their significance usually minor complications but may become major by existing lymphatic and other sequels.

Prevention is circumcision, a racial custom in a large portion of the human family and indicated whenever there has been repeated non-gonococcal balanitis, which proves an easily affected modified skin lining the foreskin and covering the glans, and whenever the phimosis is a real congenital defect and whenever paraphimosis has occurred. Abortive treatment consists only in energetic measures at the earliest sign of swelling or discharge of the same kind as curative treatment.

**Curative Treatment.**—Curative treatment is synonymous with symptomatic and is interested in the ardor urinæ, pain, tenderness, edem inflammation, retractibility and irretractibility of the foreskin. Cleanliness, rest in bed, continued attention to diet and drink are the management and avoid any increase in the inflammation. Preputi-



FIG. 18.—Author's subpreputial irrigation (original.) The patient is draped in the standard method (Fig. 15) and then a female silver catheter mounted in the Valentini cut-off is passed under the foreskin of the penis, held for cleanliness and against splash in gauze, while the high head of fluid balloons and washes out the prepuce in the Wolbarst basin.

irrigations, hot penile baths, and when the foreskin is again retractible hot washings are included under hydrotherapy for the infection and result. The author's method of irrigating the foreskin is shown in Fig. 18, and will be found most efficient with the usual antiseptic, astringent and stimulating solutions. Its technic is fully detailed on page 101 under the treatment of Balanitis.

The means are irrigations and hand injections, with the subpreputial syringe with a long tip (Fig. 7, *D* and *E*), with exactly the same drug as employed for urethral treatment, such as hot potassium permanganate, 1 in 4000 to 1 in 1000, which in the author's opinion is the best of all for the foreskin, or nitrate of silver, 1 in 5000 to 1 in 2000, weak bichloride of mercury, 1 in 5000 to 1 in 2000. Medicinal measures in astringent and antiseptic fluids at first twice, then on daily using from a half to a whole gallon each time. If the foreskin

irretractible it is the only means available aided by hand injections by the patient in the intervals, using only the long, soft-rubber or glass-tipped syringe for the foreskin. If the foreskin is or becomes retractible the glans may be painted with nitrate of silver solution, 1 in 250 to 1 in 125, every day, and the penis soaked in a tumbler of hot permanganate of potash solution, 1 in 4000 to 1 in 1000, all according to reaction; or wet dressings every two to four hours of aluminum acetate, black wash, bichloride of mercury, 1 in 5000, or lead and opium wash are serviceable against edema and a tendency to cellulitis. Relapse is guarded against by careful washing, dressing and powdering of the glans and foreskin during the rest of the urethritis. A good powder is the following:

R—Thymol iodide,  
Boric acid,  
Bismuth subgallate . . . . . equal parts

Mix, make a fine powder and mark:

Apply locally three times a day, washing the old powder off carefully each time.

Surgical measures are nonoperative and operative. Among the nonoperative means are the irrigations and applications through the short urethroscope or meatoscope already spoken of. The operative step is circumcision performed by the following technic: Circumcision should be accepted as a preventive in every male, and in the selection of case is applied to all rebellious cases of chronic phimosis. The instruments and supplies include a phimosis clamp, scalpel, scissors, forceps, hemostats, ligatures, needles and dressings and the preparation of the field is irrigation and washing with soap and water and of the patient is for a minor operation under local anesthesia in most adults and adolescents and general anesthesia in small children. The posture is supine and the glans is the one landmark, and must not be injured. It is protected by stretching the foreskin after anesthesia so that it may be retracted and its relation with the glans determined, which in children is often that of adhesion, requiring freeing. There are two methods, the clamp and the open. In the clamp method, the clamp is applied in the middle line, slightly obliquely, in order to spare the frenum and give a good posterior flap. The incision is made either distal to the clamp or, as the author prefers, proximal to it, drawing the foreskin forward, dividing it, layer by layer, and catching each prominent bloodvessel before it is divided, spurts, retracts into the cellular tissue and starts a hematoma. One side at a time is thus divided from the outer to the inner skin. When the foreskin is ablated all bleeding is stopped, the inner flap trimmed if necessary and then the edges are sutured with fine silk or horsehair in the adult, but fine catgut in the child, beginning by uniting the frenum with raphé and then the midpoints on the dorsum. These sutures are left long and held by the assistant to support the organ in the vertical position and appose the cut edges for the other stitches, placed every quarter-inch with great care not to infold. The dressing is a wick of iodoform gauze held against the suture line by the long ends of the stitches tied over it.



The open method omits the clamp, and after all the foregoing preliminaries makes a dorsal incision to the corona and then trims and removes the two flaps down to the frenum. The other steps of the operation duplicate those already given.

The immediate aftertreatment is to inspect for about an hour for bleeding and hematoma and to keep the organ supported with cotton and protected from the weight of bed-clothing. In children the application of boric acid ointment prevents wetting the dressing with urine. The adult should be directed not to soil the dressings any way. If the case is ambulant, a pad of cotton is placed upon the abdomen to receive the penis and another upon the penis itself, and over all a well-fitting prize-fighter's cotton trunk is worn. In order to urinate the patient must remove and then replace this dressing. The remote aftercare allows the catgut stitches in children to drop away but the silk or horsehair in adults to be cut out on the seventh to the ninth day and suitable stimulating dressings to be applied to granulating spots. The glans often remains extremely sensitive for many weeks in adults and must be soothed with ointment and cotton.

*Cure* in nonoperative cases is the relief of the edema and infection and the restoration of retractibility of the foreskin, which is always possible except in cases of congenital abnormality.

The cure in operative cases should show a penis with the glans fully exposed but with the stump of the foreskin not tight but slightly loose behind the corona without covering the same.

**Treatment of Gonococcal Acute Paraphimosis.**—Significance, usually of minor importance, occasionally major through ulceration and loss of gangrene. Prevention directs no attempt at retraction of the foreskin when either it or the glans has been obviously inflamed and suggests prompt and proper attention to a phimosis so that the paraphimosis will not develop. Immediate replacement of a retracted foreskin showing constriction back of the glans, with swelling and edema, is the only abortive measure, and is done by massage, as shown in Fig. 16 and the following paragraphs:

*Curative Treatment.*—Curative treatment requires cleanliness, rest in bed, with the penis supported, and nonirritating diet and dress as the hygiene against increasing any of the factors of inflammation and ulceration. Decongestion is found in hot antiseptic penile baths and hot sitting baths among the physical methods, and digital reduction of the deformity is the massage of these cases. Local wet dressings of hot lead and opium wash, aluminum acetate or bichloride of mercury 1 in 5000, for sedative, antiseptic and astringent effects, introduce medicinal measures. Early cases may be reduced by massage in the following nonoperative surgical procedure: edema is gently pressed from the glans and foreskin, so that each becomes soft instead of tense. Acupuncture of the foreskin, with a needle under antiseptic precautions, may be necessary for the evacuation of serum. The two thumbs are then placed against each other for support on the glans while the two index and middle fingers seize respectively the dorsum and ve-

of the penis well back of the constricting band. By pushing the glans into the ring of the paraphimosis and pulling the ring over the glans at one and the same time, a coördinated motion of thumbs and fingers toward one another, the paraphimosis will often be reduced. The constricting band must finally be felt free of the glans in the foreskin in front of the meatus. An antiseptic wet dressing should be used immediately after successful restoration, also subpreputial irrigations and hand injections. Older and irreducible cases require operative measures after a local anesthetic of cocain, novocain, stovain or their analogues injected into the midline of the dorsum above and through the constricting band, and after sterilization of the ulcer with tincture of iodine, the band is divided, layer by layer with a scalpel until it is fully cut through and the tunica albuginea is seen at the depth of the wound. Such incision is usually three-quarter inch long and permits immediate restoration of the parts, followed by wet dressing. The dorsal vein of the penis is sometimes cut in this operation and will bleed unduly unless ligated. An equally good technic is to buttonhole the skin in the normal zone above the constricting band and then pass a blunt grooved director down to and along the tunica albuginea and beneath the band so far as the corona glandis. Upon the director the band is then cut through in its entire thickness and breadth with one stroke of the knife. The author prefers this method because the director isolates and retracts the band away from the body of the organ. A wet dressing is again the immediate aftertreatment, which is continued on surgical lines until the little wound is healed and the remote aftertreatment is summed up in the toilet of the foreskin against return of the paraphimosis and in circumcision as permanent relief of the underlying and resulting deformity.

*Cure* requires recovery from the infection and gangrenous ulcer without any or much deformity. Reparative measures against unsightly flaps complete the case.

### BALANITIS, POSTHITIS AND BALANOPOSTHITIS.

**Definition.**—The glans is covered with and the foreskin is lined not by mucous membrane, as formerly supposed, but by modified skin which is capable of infection and inflammation. When the glans alone is affected the lesion is known as balanitis, and when the foreskin is chiefly involved the term posthitis is used, and finally when the inflammation is generalized it is called balanoposthitis.

**Varieties.**—The following types may be distinguished: (1) as to site, balanic and posthic as localized and balanoposthic as generalized; (2) as to course, acute, subacute, chronic and relapsing; (3) as to foreskin, retractible and irretractible; (4) as to degree, mild, marked and severe; (5) as to infection, suppurative, croupous or diphtheritic, syphilitic, chancroidal, gonococcal, diabetic and herpetic. Distinction as to the course, retractibility of the foreskin and form of infection is

important, and this work is concerned with the gonococcal, which is taken as a type.

**Etiology.**—Etiology is predisposing and exciting. The predisposing cause is peculiarity or defect of the foreskin summed up in phimosis and deficiency. Phimosis with its long or redundant, straight or angulated, tight or flaccid, small or strictured outlet and deficient or elongated frenum, imprisons the normal smegma in its folds, stimulates its decomposition and invites infection from any source, so that in gonococcal invasion the pus from the urethra easily travels into the recesses and produces characteristic inflammation. A deficient foreskin may by exposure to irritation also predispose. Trauma in causing loss of epithelium is an important predisposing cause, such as arises during excessive coitus, masturbation and the friction of warts with the foreskin. Intercourse with a woman having too small genitalia for the penis of the man acts in the same way, and the acidity of leucorrhea and of the normal vaginal secretion just before, during or just after the menses may also prepare the modified skin for infection. The exciting cause is therefore penetration of any organism into the favorable soil thus prepared, or in virtue of the decomposition of smegma the change of organisms normally present, from innocuous to nocuous types, occurs. According to the variety of organism gaining access the types of disease are recognized. The pyogenic germs evolve suppurative, the gonococcus, gonococcal; the *Treponema pallidum* syphilitic; the *bacillus of Ducrey*, chancroidal; and the decomposition and infection of sugary urine diabetic balanitis. Herpes progenital may cause active lesions in the same manner as chancre and chancroid.

**Pathology.**—All ages from infancy to advanced life have the same essence of process, which is infection of the modified skin of the glans and foreskin, with suppurative, gonococcal, syphilitic, chancroidal or diabetic inflammation. The temporary lesions are the commonest and comprise superficial desquamation or erosion and ulceration in accordance with the activity of the process. In the suppurative and gonococcal lesions, ulcers are relatively uncommon, but are the nature of the chancre in syphilitic and of the soft venereal sore in chancroid disease, and are by no means rare as gangrene in diabetes. Permanent lesions are absent except as the scars of deep erosions in the violent suppurative and gonococcal cases and of chancres, chancroids and gangrene. The associated lesions do not occur in suppurative and gonococcal balanoposthitis unless extreme, but in syphilis the systemic pathology of the disease may be already present or soon appear, and in chancroid an active lymphatic involvement may be present and diabetes gangrene of the foreskin. The complicating lesions are usually lymphangitis and lymphadenitis. These may be absent or very marked. In suppuration and gonococcal disease of the foreskin if the glans they are rare—if marked, then a mixed or associated infection must be looked for. In syphilis the vessels are cordlike and the glans indurated, discrete and movable and in chancroid the vessels are inflamed and tender and the nodes indurated, matted and fixed to

skin and deeper parts. Abscess of the glands is not uncommon in chancroid. Diabetic gangrene may have much the same complications. Herpetic lesions show the papular, pustular or ulcerous spots, individually or collectively, with the other signs of balanitis and posthitis. These lesions are all mild and temporary. According to the type of disease, the infecting organisms are regularly: the normal flora of the foreskin (evolved to vicious activity), the gonococcus, the *Treponema pallidum*, the *bacillus of Ducrey* and a variety of organisms in decomposing diabetic subpreputial deposits. No definite organisms are identified with herpes.

**Symptoms.**—These vary with the degree of the disease and not materially with its distribution as balanitis, posthitis or balanoposthitis, and are purely local because in the strict sense subjective and objective systemic signs are absent. Exceptions to this rule are manifestations of the constitutional disease in syphilitic and diabetic patients and of active general absorption in chancreoid and gonococcal infection. Symptoms of the invasion, establishment, termination and complications are seen. The period of invasion is usually very mild in the simple cases and masked by the gonococcal urethritis in this form of balanitis. If present in this period at all the signs are extremely mild and of the same kind as in the establishment of the process. The local subjective symptoms in gonococcal balanitis are more violent than in the simple suppurative form, but the former is the more common and directly in our interest. The chief complaints are sensations and discharge. The sensations vary among itching, pain, burning, feeling of foreign body under the foreskin and desire to rub or pull the foreskin about. These symptoms are known by the intelligent patient not to be in the urethra, because they continue after the urethra has been cleansed by the act of urination. In retractible foreskin, the discharge is noticed only from the folds and not from the urethra, and in irretractible foreskin it appears on pressure on the prepuce rather than on the urethra, after the canal is freed of gonococcal pus by urination. If erosions and superficial ulcers are present the patient will often seek advice for these after neglect of the stage of discharge, on the theory that he has chancres or chancroids.

The local objective signs are determined by the degree of the attack, being few in mild, many in marked and many and severe in extreme cases.

**I. Cases with Retractable Foreskins.**—The glans alone or with the foreskin in part or whole is red, glistening and edematous in mild cases and early stages of severe forms. Maceration, desquamation and erosion in spots, large areas or universally mark further progress. Vesicles and pustules are frequent, which break under retraction of the foreskin and simple cleansing of the parts, leaving behind erosions or ulcerations at their bases. The discharge is either characteristic of gonococcal urethritis or modified by the addition of the balanitis and foul smegma. It is milky and has a disagreeable penetrating odor, regarded as diagnostic of the simple cases. Gonococci are present in

the discharge combined with the organisms of suppuration, catarrh inflammation and of the normal flora of the prepuce. The discharge wells up from the folds of the foreskin and especially back of the corona. Severe types are the extremes of the disease and occur in patients with poor health and without resistance to disease and in persons with uncleanness from habit or occupation. Ulcerations may extend like and must be distinguished from chancroid and neoplasm and the lymphatics may be involved in acute inflammation of vessels and glands and even inguinal abscess.

*II. Cases with Irretractible Foreskin.*—Inspection of the part is possible only with urethral specula, of which none is more convenient than the Skene-Folsom, short Chetwood or Buerger. The outlet of the foreskin is dilated with the blades of the Skene-Folsom speculum and its cavity illuminated with a lamp and head mirror or a urethrosopic lamp and the pus carefully wiped from the urinary meatus. Pressure on the foreskin then brings into the field volumes of pus which do not come from the urethra. The Chetwood or the Buerger urethroscope may now be inserted to the corona for determination of the other conditions described. In both forms of the disease, palpation of the foreskin and glans is usually very painful, independently of the urethral inflammation, of which the balanoposthitis is a complication. When these special instruments are not at hand the following procedure serves: A pledget of cotton may be inserted into the meatus in order to retain the gonococcal pus of the urethritis, after having cleaned the tip of the glans, as seen through the opening of the foreskin. Gentle pressure upon the penis back of its head and away from the urethra will always bring away pus into the field, which obviously cannot come from the urethra on account of the plug of cotton which is then removed.

The stage of termination in gonococcal balanitis is not as well marked as in the simpler forms, because masked in exactly the same way as the invasion. It may be said, however, the subjective symptoms decline and sensations of the balanoposthitis slowly merge into those of the persisting urethritis if this is acute, but if chronic then the distinction between the two processes is marked. The objective symptoms disappear. The discharge lessens and rapidly ceases under cleanliness, dressing, drainage and treatment, so that again only the gonococcal discharge from the urethra is present. Erosions, desquamation and maceration of epithelium soon heal, leaving normal modified skin. Ulcers heal more slowly and leave scars of various number, size and depth behind. If severe complications have been present in lymphatic vessels and glands these will heal slowly also. Full recovery is the rule without permanent damage in the gonococcal and suppurative type. But in the ulcerating lesions, such as chancroid and chancre, and in diabetes, destruction of glans and foreskin may be extensive.

The symptoms of the course and termination of the other forms of balanitis have been sufficiently discussed under the subjects of phimosis of the same varieties—namely, syphilitic, chancroidal, diphtheritic and diabetic.

**Complications.**—Complications of gonococcal balanitis occur less frequently than with the ulcerating forms and are of the same types as follow: Phimosis and paraphimosis are not only causes but also complications or sequels of balanitis, and a careful history of the case alone distinguishes the onset. Lymphangitis is usually indolent and cordlike, but may be active and tender, and lymphadenitis may likewise be subacute and scarcely painful or acute active and painful, with outcome in abscess. Cellulitis of the skin sheath of the penis in whole or part as a universal or localized inflammation may follow the lymphatic involvement or occur more or less without it. The gonococcal urethral lesions from which the balanitis proceeded are associated rather than complicating lesions. Gangrene arises in diabetic balanitis and is worthy of separate note. On this point Taylor<sup>1</sup> says: "Not infrequently, particularly in uncleanly persons, in diabetics, also in those debilitated by disease or excesses, gangrene of the prepuce occurs from balanitis. Owing to the inflammation of the parts and the swelling of the glans, a black spot forms about the middle of the prepuce and through the buttonholelike opening which results, the glans protrudes."

That which is said concerning the lymphatic system of the penis in the following paragraphs under the subject of lymphangitis and lymphadenitis applies to all these foregoing conditions and these anatomical facts should always be borne in mind.

**Diagnosis.**—Balanitis, posthitis and balanoposthitis are lesions differing from each other simply in distribution as noted in the definition of the acute and chronic forms in their appropriate sections on pages 89-97. Balanitis is limited to the glans penis, posthitis to the lining of the foreskin and balanoposthitis to both regions combined. Distinction between the acute and the chronic form is one of activity of process and history, because the diagnostic procedures are the same for each.

The history acknowledges any or several of the following causal elements: Phimosis, paraphimosis, excessive or unnatural intercourse or union with a woman having undeveloped external sexual organs, acute or chronic urethritis especially with relapses, and indolent sore suggesting syphilis or a more active ulcer indicating chancre, warts with their irritation and discharge, and perhaps pruritus of the genitals common with diabetes. The subjective symptoms concern the degrees of itching, burning and discharge, primary or secondary to any of the foregoing causes and, especially for our purposes, to acute and chronic gonococcal infection or otherwise consequent upon sores, warts and sugar in the urine. Presence of the gonococcus may be an intercurrent factor and not either exciting or complicating the lesion. The objective signs determine the source and bacteriology of the discharge and its effect on the cavity of the foreskin and settles the relation of possible etiologic data as just

<sup>1</sup> Loc. cit., p. 246.

stated. The treatment of the case is of value in setting apart from each other the various recognized forms, most especially the syphilitic chancroidal, true diphtheritic and diabetic.

**Differential Diagnosis.**—The differential diagnosis contains the history of ardor, pain and tenderness only about the foreskin and glans and not within the urethra and in showing only the first glass of urine slightly turbid. Posthoscropy shows the cavity of the foreskin alone to be involved and the urethra to be normal.

Differential diagnosis of the varieties of balanitis from our chief subject, gonococcal manifestations, must include suppurative, diphtheritic, syphilitic, chancroidal, diabetic, papillomatous and cancerous disease.

*Suppurative differs from gonococcal balanitis* in its history of frequent often unexplained attacks or otherwise origin from simple causes in its freedom from the gonococcus and abundance of catarrhal or suppurative organisms; in its subjective symptoms often mild, simple and brief and independent of urethritis or its complications and sequels; in its objective signs of chiefly redness and edema, rarely excoriations and of pus from the folds of the foreskin and not from the urethra in its prompt and complete response to simple cleanliness, antiseptics, stimulation and dressing; and finally in its termination in full recovery as the rule with rare exceptions and without persistence of urethral lesions thereafter.

*Diphtheritic or croupous differs from gonococcal balanitis* through its record of no gonococcal disease but of infection of a wound or operation on the foreskin or of involvement during acute systemic disease or its prolonged convalescence, such as scarlet fever, measles, small-pox, diphtheria, typhoid and the like; in its subjective symptoms of severe reaction to operation and intense involvement of the cavity of the foreskin showing severe pain, bleeding and discharge and in its objective signs such as scales and flakes of false membrane which are shed from the surface of the glans and lining of the foreskin with absence of the gonococcus but presence of the bacillus of diphtheria or other organisms; in its response to antidiphtheritic serum as treatment and to other active antiseptic measures and finally in its termination without the persistence of urethral lesions of gonococcal nature and at times with the sequels of diphtheritic infection. In typical cases the membrane is the duplicate of that seen in diphtheria of the throat, grayish-white or reddish-white in color, leaving ulcers behind and having tendency to early involvement of the inguinal glands exactly as the cervical glands are comprised in lesions of the throat.

*Syphilitic differs from gonococcal balanitis* in its acknowledgment of slow invasion in the third to the sixth week of chancrous and the sixth to the twelfth week of macular and papular lesions of the second stage; in its subjective symptoms of comparative painlessness and unimportance until the discharge appears as chief complaint; in its objective findings of no gonococci, of a chancre or papule seen under or felt through the foreskin with the *Treponema pallidum*; in the foul-smelling serous or serosanguineous discharge and tissue and of other



signs of syphilis, such as characteristic lymph vessels and glands, generalized rash of the skin and moist papules of the mucosæ and positive Wassermann test; in its prompt response to local and systemic antisyphilitic measures of treatment and finally in its termination at the same time as the other signs of syphilis, if present, or emergence with them at their appearance as part of the general syphilitic process. Balanitis may appear in the stage of erythema in the very early secondary period or in the gumma of the tertiary period. Manifestly retractile foreskins permit a prompt and accurate diagnosis while irretractible ones limit examination to palpation and inspection through a speculum.

The varieties of a chancre described by Taylor<sup>1</sup> must not be forgotten: Chancrous erosion, silvery spot, dry papule or patch, umbilicated papule or nodule, purple necrotic nodule and ecchymatous chancre as typical forms, and ulcer elevatum, multiple herpetiform chancre, parchment chancre, annular chancre, indurated nodule or mass, chancre with cream-green membrane and infecting balanoposthitis as atypical forms. As a source of error the infecting balanoposthitis is highly important but usually shows at one or more points diagnostic infiltrations of syphilis. A section, however, of every suspected lesion must be sent to a pathologist.

*Chancroidal* differs from *gonococcal balanoposthitis* in soon after intercourse giving a history of active ulcer, neglected until pain and discharge appear; in its subjective symptoms of pain, bleeding, acute discharge and early involvement of the inguinal glands, with, on objective examination of the retracted foreskin, a characteristic soft venereal ulcer, containing the *bacillus of Ducrey* and without urethritis unless the chancroid is at the meatus, and then without gonococci and with early acute tender involvement of the inguinal glands and penile vessels; in its rather slow response to treatment with tendency to extension and autoinoculation even during applications and finally in its termination in excavated deforming scars of glans and foreskin and not uncommonly in abscesses of the groins. As stated in the previous paragraph on syphilitic balanitis, cases with retractibility of the foreskin permit immediate diagnosis while those with irretractible phimosis render the process much more difficult. In the late untreated cases signs of pus in the lymph glands of the groins are important—namely, redness, glossiness, edema, fixation of the skin, swelling, tenderness and tension or fluctuation of the glands.

*Diabetic* differs from *gonococcal posthitis and balanitis* in its knowledge of sugar in the urine with absence of gonococcal or other urethral lesion, except at times diabetic urethritis; in its subjective symptoms of severe itching like the pruritus of the genitals and anus which often precede it with sometimes glycosuric urethritis; in its objective signs of acetone breath, sugar in the urine, lividity, excoriation and exfoliation of the epithelium in the discharge which contains decomposing

<sup>1</sup> Genito-urinary and Venereal Diseases, 3d ed., p. 500.



smegma and microorganisms, with tendency to ulcer, gangrene and verruca; in its benefit through relief of sugar in the urine and local cleanliness and finally in its termination in recovery or a severe gangrenous sequel or in its relapses with every return of sugar in the urine. In doubtful cases, having no sugar in the urine, hematological examination will reveal its accumulation in the blood where sugar is pathologically present before it appears and after it disappears from the urine.

*Papillomatous or warty differs from gonococcal balanoposthitis* in the notice by the patient of warts preceding the condition, of almost total absence of pain and inflammation. Objectively the condition is purely a mechanical irritation of the parts into a catarrhal inflammation. Retraction of the foreskin at once reveals the diagnosis, as will posthoscropy. Edema is usually absent unless the inflammatory change has been profound. The discharge is mucoserous or mucopurulent and contains no organisms of syphilitic, chancroidal or gonococcal infection unless in the last instance the papillomata complicate a chronic urethral lesion.

*Cancerous differs from gonococcal balanoposthitis* in that it is preceded by the typical induration and ulceration of epithelioma and followed by the usual infiltration and fixation of the mass and the lymph vessels and lymph glands in relation to it. Inflammation is relatively little excepting in the ulcer itself. The discharge is sanious fertile in the products of the ulcer but barren in the special organisms already mentioned. A section is the final diagnostic aid.

*Cardiovascular differs from gonococcal balanoposthitis* in that it is secondary to disease of the heart, vessels and kidneys, being accompanied by pronounced edema of the lower extremities and sexual organs, which produces a manifest phimosis. Extreme cases of this condition are at times seen. Inflammation of the foreskin is relatively little in most cases. The discharge would necessarily be mucus serum or mucoserum and devoid of any infectious organisms. Examination of the heart, bloodvessels, liver, lungs, kidneys and urine immediately clears the diagnosis (Fig. 17).

**Chronic Balanitis, Posthitis and Balanoposthitis** are involved like phimosis with frequent attacks of any of the foregoing forms as their causes until at last a persistent or a relapsing inflammation is established. The symptoms are those of infiltration, excoriation, fissure and discharge. The features of the various forms just described need not be repeated. When the foreskin is irreducible examination with the meatoscope or the urethroscope reveals these lesions.

**Treatment of Gonococcal Acute and Chronic Balanitis, Posthitis and Balanoposthitis.**—These lesions are in their significance common minor, rarely major. Prevention and abortion rely on the treatment of phimosis and allied conditions, which in both the congenital and acquired forms are very apt to have a balanoposthitis—acute or chronic with relapses or chronic with persistence and progress of symptoms. As the best preventive, circumcision is indicated whenever there has been an acute nongonococcal attack or chronic lesions.

*Curative Treatment.*—Relief of these complications must be determined by the indications.

Curative treatment develops in accordance with the acute or chronic symptoms of itching, pain, ardor urinæ, rubbing of the foreskin and discharge free at the opening in irretractible cases or held within the folds of retractible foreskins associated with excoriations and ulcerations. Antisepsis of the discharge, rest in bed with the penis supported, diluents and antacids in drink and food are the management and hot irrigations, hot penile baths and sitting baths against the edema and discharge are the hydrotherapy. In retractible cases medicinal measures are hot antiseptic and astringent penile baths for twenty minutes twice a day, preferably of potassium permanganate 1 in 4000 to 1 in 1000, aided by hand injections of the same every two hours with the long rubber tip subpreputial syringe. Painting or washing the glans and foreskin with nitrate of silver, 1 in 250 to 1 in 125, is almost magic especially for the ulcers and excoriations. Drying and antiseptic powders and the standard penile dressing (Figs. 10 and 11) are the last step. In chronic cases the applications are usually somewhat stronger. In irretractible cases the only means are irrigation of the foreskin by the author's method and hand injection. When retraction is again possible return to the other methods is indicated.

Relapse is prevented by the toilet of the foreskin during the urethritis.

*Author's Subpreputial Irrigation.*—This means of treatment requires a reservoir, tubing, the Valentine or other cut-off and shield, a female catheter with a hub fitting the shield, both as shown in Fig. 18, as equipment. The patient is prepared with the standard draping (Fig. 15) reclining on the operating table or standing exposed as in Fig. 13 before a sink or other office fixture. The technic passes the catheter under the foreskin while gauze is dropped over penis and catheter to catch all splash and lead it into the Wolbarst basin between the thighs. The flow is opened at high head of pressure to balloon out the foreskin and about one gallon of irrigation is used, of 1 in 4000 to 1 in 1000 hot potassium permanganate solution, twice a day.

Cure requires relief of the infection without preputial folliculitis or other complication and without tendency to chronicity. Aftertreatment is circumcision which cures the underlying congenital deformity and the natural tenderness of the parts seen in phimotic subjects. The operation is usually done after all gonococcal disease is absent and especially if the thickenings of chronic phimosis are present.

### PREPUTIAL FOLLICULITIS.

*Definition.*—This acute complication may be described as gonococcal infection of the follicles of the prepuce, which are really glands with ducts much like those within the urethra itself and for the most part evacuating at or near the margin of the foreskin where the true and modified skin meet.

**Varieties.**—Acute, subacute and chronic are the clinical types, of which the last is discussed later. Cases without abscess and with abscess of the foreskin itself and abscess of the follicles near the frenum are forms as to severity. Such abscesses are rather minute, though unmistakable and are not to be confused with periurethral abscesses of large proportions and described under their own heading.

**Etiology.**—A long, tight foreskin is the predisposing local cause, with a tendency to frequent attacks of simple balanoposthitis through retention and decomposition of smegma. This condition results in relaxation and patency of the ducts and invites the penetration of the gonococcus as the exciting cause during the balanoposthitis which always occurs in such a foreskin.

**Pathology.**—As in all other gonococcal invasion the essence of the process is penetration of the organism along the duct and into the gland followed by exfoliation, proliferation of the lining, pus formation containing gonococci, modified secretion and detritus. The temporary lesions are these and seen only in mild cases of true folliculitis without abscess, but the permanent lesions are destruction of the gland by the abscess, which leaves chronic sinus or even urethro-preputial fistula.

**Symptoms.**—So slight a lesion has no invasion distinguishable from the gonococcal acute urethritis which it complicates. In fact, in irretractible foreskins it is often not recognized until the declining stage reveals the sinus or fistula. In a retractible foreskin, the subjective establishment is manifested by discomfort, pain and discharge, or by relapses of balanoposthitis bringing the folliculitis to the front. Objective signs are redness, edema and enlargement of the gland and its duct from which pus containing gonococci dribbles or may be expressed. The refined sensitiveness of minute abscess is always present. The termination is commonly by spontaneous external evacuation if no abscess occurs, or rupture upon the surface of the foreskin or near the frenum or very rarely into the urethra. Complete healing may then occur or a chronic infiltration, sinus or fistula result. The clinical significance of these little lesions is that they may be the carriers of infection into wedlock or even of autoinfection under a simple exciting cause.

**Diagnosis.**—In the history of acute preputial folliculitis during a gonococcal urethritis the follicles of the prepuce are invaded and little abscesses appear, with their characteristic symptoms of pain, redness, swelling and finally evacuation. The pus may be expressed in little plugs without or with incision of the abscess and a small pocket remains.

**Chronic Preputial Folliculitis** shows numerous acute attacks in its history with the result of a persistent focus or pocket which is always open and relapsing and has the symptoms of a chronic discharge, sinus and node of unhealed abscess if there is no occlusion of the sinus, but if its outlet becomes stopped then an acute folliculitis with all the foregoing features originates. The laboratory is interested in smears and culture taken from these abscesses and in the free pus of the fore-

skin for the gonococcus. Treatment of the urethritis may aid in the disappearance of this complication especially if attention to the cavity of the foreskin is given before true abscesses appear. Otherwise minor surgical attention settles the diagnosis.

### PARAURETHRAL FOLLICULITIS.

**Definition.**—Paraurethral or juxtameatal folliculitis is a complicating gonococcal condition recognized as infection of the little glands at or near the meatus leading to suppuration, abscess, sinus or fistula, lying along the urethra and evacuating in or near the lip of the meatus on the surface of the glans and not on the lining of the urethra.



FIG. 19.—Gonococcal paraurethral folliculitis with abscess. The abscess has not yet ruptured and obstructs the meatus. No sinus is therefore apparent. (Taylor.<sup>1</sup>)

**Varieties.**—Acute, subacute and chronic are the clinical lesions while unilateral and bilateral as to situs and large and small as to extent are recognized, as well as cases without and with abscess.

**Etiology.**—The causes of paraurethral folliculitis duplicate those of the preputial follicles and need no further discussion.

**Pathology.**—Unusually large follicles situated along the margin of the meatus emptying upon the glans are the basis of the process while infection with the gonococcus followed by the usual processes excited by it is the essence of the disease. The ducts open laterally upon one lip in unilateral cases, both lips in bilateral forms and at either upper and lower commissure in mesial cases, almost always externally but occasionally externally and internally, thus forming balanourethral fistulae. The length of such passages is from 1 to 2 cm. Temporary lesions are seen only when there is no abscess, while permanent lesions with destruction of the follicle, slight stricture of the meatus, chronic sinus and fistula are common. The associated lesions are regularly those of the gonococcal acute urethritis which they complicate.

<sup>1</sup> Loc. cit.



**Symptoms.**—In so minute a lesion there is commonly no discernible period of invasion, the patients complaining only of the subjective establishment of the abscess or of a discharge from a particular point of the meatus, lateral or central, during the declining period of the gonococcal infection or only of the persistent crusting later on. The objective signs are a red, swollen edematous lip in recent cases or normal in old lesions with patulous duct, "pinhole" to the naked eye or magnifying glass, discharging pus spontaneously or permitting its expression. A probe will enter 1 or 2 cm. into a blind sinus or a balanourethral fistula. Crust over the meatus when removed will reveal these conditions which are the sole origin of the crust in many cases, as distinguished from urethritis. The termination is in mild cases recovery. Glands with short, simple ducts also tend toward recovery or a chronic discharge without abscess. Those with long, tortuous ducts more often have abscess, frequent relapses with exacerbations followed by sinus or fistula. The clinical importance of these lesions is that without discomfort they may persist for years and become the source of infection in marriage or of autoinfection through some slight cause. Hence, the little drop of pus within them should always be examined for the gonococcus.

**Diagnosis.**—Added to the history in acute paraurethral folliculitis of a severe urethritis is that of a rapidly developing swelling exactly at the meatus on one or both sides with the symptoms at first of pain edema and obstruction and then discharge of a drop of pus, frequently recurrent. Expression of the pus from the small abscess cavity is usually easy with the fingers alone, but frequently this method develops pus from the urethra also.

**Chronic Paraurethral Folliculitis** shows an origin in acute complicated attacks in its history or several attacks of urethritis resulting in the abscess and then the chronic sinus with a mass of infiltration tissue about it and with the symptoms of pain and discharge like an acute abscess when the opening closes or of chronic drop if it remains open. The probe and the meatoscope complete the diagnosis. A hairpin or other loop may be passed into the urethra beyond the abscess and used to express its contents absolutely for laboratory demonstration of the gonococcus in smear and culture. Under treatment as the urethritis subsides the drop of pus from the follicle persists and does not cease until local applications or incision and drainage obliterate the pocket and complete the diagnosis.

**Treatment of Gonococcal Acute and Chronic Preputial and Paraurethral Folliculitis.**—Almost invariably minor and not major importance attaches to these lesions. Prevention is only the toilet of the foreskin in irrigations, powders, baths and the like from the onset of the urethritis and the only abortive means are hot antiseptic local applications at the first sign of folliculitis but are usually of no avail. **Curative treatment** is much alike in both these lesions which differ only as to their sites respectively in the foreskin and the meatus and symptomatic according as the abscess is acute and blind or is evacuated.

chronic with pocket or sinus causing pain, discomfort, enlargement, perforation, discharge, pocket, sinus and associated balanoposthitis.

Electrotherapy in the form of the high-frequency current of Oudin is valuable when the wire may be readily introduced into the follicle. The spark gap should be one-eighth inch or less and the switch half open. The current should blanch and not char in a few seconds and the electrode should not bring away tissue with it. The medicinal measures are chiefly against the balanoposthitis as prescribed. Incision, evacuation and sterilization of recent cases is the best surgical treatment, while old cases may require curetting and stimulation, occasionally ablation.

*Aftertreatment* provides against relapse or recurrence by proper attention to the balanoposthitis.

*Cure* requires healing of the abscess cavity so as not to become a source of chronic infectiousness.

### PERIURETHRAL FOLLICULAR ABSCESS.

**Definition.**—To abscesses of variable but rather large size, situated along the urethra from glans to penoscrotal angle, the term periurethral is applied and should distinguish them from the much smaller and less significant abscesses in small follicles near the frenum just dismissed as preputial folliculitis.

**Varieties.**—Forms are distinguished as to situs, frenal, penile and penoscrotal, unilateral, bilateral and discrete, bilateral and confluent and finally bilateral by extension and as to severity without and with sinus and fistula formation. Bilateral abscesses may arise individually on either side of the frenum which is the commonest seat and remain discrete or become confluent into a common cavity or after arising on one side may erode into the other and thus simulate the former kind.

**Etiology.**—A long, tight foreskin with tendency to sodden mucosa, to frequent simple balanoposthitis, to decomposition of smegma, and to relaxation of all ducts is the predisposing cause and the penetration of the gonococcus is the exciting cause, so far as the frenal type is concerned. The penile and penoscrotal types arise from similar infection of the larger urethral follicles. They are regularly associated with any period of severe gonococcal urethritis, that is, the full establishment, decline or termination, and during chronic urethritis, as subsequently discussed, they are by no means uncommon under any additional exciting factor.

**Pathology.**—Typical gonococcal abscess formation follows occlusion of the duct of the follicle about the frenum or within the urethra with probably unilateral frenal situation the most common. The other situations are spoken of under varieties. The essence of the process is invasion of the gland and duct, exfoliation, penetration of the organism, infiltration, pus and detritus, occlusion of the duct, destruction of the gland and finally involvement of its annexa in extensive abscess. Manifestly temporary lesions are not seen as the destruction is marked.

The permanent lesions are a fibrous nodule in the simplest cases, but much more commonly a sinus evacuating into the sulcus of the corona or into the urethra or a fistula connecting the cavity of the foreskin or the surface of the skin with the urethra. The associated lesions are regularly those of the intense gonococcal urethritis which precedes or is accompanied by these abscesses. The persistence of the sinuses and the fistulae with little discomfort to the patient but with danger of autoinoculation or infection of an innocent party is the clinical importance of these cases. The smear, culture and blood-tests for gonococcal disease should always be carefully made.

**Symptoms.**—The majority of these abscesses arise with local subjective invasion during the declining stage of the urethritis and by their pain, enlargement and obstruction attract the patient's attention, even before their full establishment, which increases these symptoms. The systemic subjective and objective signs are not common but when present may be those of any pus-focus, chill or chilliness, fever, malaise, prostration and the blood-count. The local objective conditions are at the onset a distinct red spot, like a pimple, near the frenum or a nodule along the anterior urethra in front of the scrotum, rapid enlargement into a spheroid or ovoid abscess, infolded in the foreskin with edema of moderate or large extent immediately around it, and sometimes obstruction of the urinary stream. In the termination complete resolution is the exception, but the rule is an infiltration, sinus or fistula as described under pathology and having the same clinical importance for the patient and his future wife already spoken of under preputial and paraurethral folliculitis.

**Diagnosis.**—In its history acute periurethral abscess is found in severe or otherwise complicated acute or relapsing chronic urethritis and has severe symptoms of swelling of the urethra downward around the corpus spongiosum at any point and to any reasonable size, at first without and then with evacuation of pus, which recurs intermittently. Downward enlargement is enforced by the corpora cavernosa penis above. Pressure on the swelling in the early period develops no pus but in the later period shows a spurt of pus especially if the urethra has been previously washed clean. Urethroscopy may develop the mouth of the abscess as occluded or open.

**Chronic Periurethral Follicular Abscess** presupposes an acute attack in its history with one or more abscesses which have never recovered and its symptoms suppuration which is indolent and persistent or active and variable according to occlusion of the opening of the abscess into the urethra. Urethroscopy will reveal the infiltration of the mucosa and the sinus and permit with the ureteral catheter or probe exploration of the same and sometimes recovery of pus.

The laboratory specimen for smear and culture of the gonococcus is essential. Treatment of the urethritis will cause minor abscesses to disappear but the more severe ones may continue after the urethra is well and require individual management through the urethroscope which still further proved their nature.

**Treatment of Acute and Chronic Gonococcal Periurethral Follicular Abscess.**—Its significance is usually minor, but may in chronic cases become major through absorption and infectiousness, and prevention suggests gentle means and no violence to avoid extending the infection into the glandules of the mucosa. Mild concentration of fluids, minimal force in irrigation by the Janet or Chetwood methods or preferably by the syringe-and-catheter method are required. Abortion in the real sense cannot be done as the onset is masked in the other symptoms of the urethritis.

**Curative Treatment.**—Curative treatment is developed by the pathologic and symptomatic indications according as the cases are acute or chronic and without or with a sinus. The symptoms without sinus for relief are pain, enlargement, edema and obstruction and with sinus they are relapses with discharge or a constant discharge. The management embraces the typical hygiene, rest in bed with the penis supported, careful diet and drink and regular bowels. Massage is contraindicated in acute cases exactly as instrumentation is but in chronic cases often aids with the sound *in situ* to evacuate the indolent contents of the abscesses or sinuses and to stimulate resorption. Hydrotherapy is of more avail in acute than chronic cases to reduce edema and swelling and relieve mild obstruction and consists of hot penile and sitting baths which if well done may prevent formation and rupture of the abscess.

Electrotherapy is contraindicated in the acute forms but in the late periods is of value against the infection and relapses. The glass electrodes of the x-ray tube vacuum attached to the negative pole of a high-speed multiple plate static machine are correct to employ against the organisms while cataphoresis with a metal electrode attached to the positive pole of the galvanic machine with a current of 3 to 5 milliamperes is used against the chronic discharge without infection.

Serotherapy in the declining or sinus stage may be attempted for increasing resistance and immunity. The serum may be used earlier than the bacterin but without producing a negative phase which would add to the progress of the disease. The autogenous bacterins or the heterogeneous bacterins will produce active immunity as compared with the serum and its passive immunity. The methods are discussed in the section on Serotherapy in Chapter IX on General Principles of Treatment on page 512. On the whole this treatment is not very satisfactory.

Medicinal measures are against absorption, if present, by catharsis, diaphoresis and urinary antiseptics and diluents by systemic administration. If there is no sinus the local measures are cessation of hand injection, hot penile and sitting baths and hot irrigations when the decline appears by the methods already described for the syringe-and-catheter method under acute anterior urethritis. Nonoperative surgery consists in wet dressings of astringents, antiseptics and sedatives such as bichloride of mercury, potassium permanganate, alum acetate, lead and opium wash and lead water—often with improvement in many symptoms. Catherization may be gently used to overcome obstruction.



Operative means are cautious against premature and immature treatment, as overtreatment is likely. The abscess is incised through the meatus if accessible or through the urethroscope for free evacuation of pus and instillation of the cavity with argyrol, nitrate of silver or iodine. If the sinus opens externally it should be left alone until several months after the urethritis is thoroughly healed and all resorption possible has occurred. Then a straight sound is passed into the urethra and the sinus or fistula opened carefully along its course, previously stained with methylene blue, down to the mucosa and rarely through it. Ligature at this point will sometimes close the sinus or the whole mass may be dissected free to the mucosa and ligated and moved and the defect sutured.

Dilatation with soft sounds during the subacute or succulent stage and with straight steel sounds during the late chronic or infiltrating stage is indicated for urethral obstruction, but ever without a reaction such as pain, bleeding or temporary increase in the symptoms, because such foretell true stricture formation. In the acute period a soft catheter is used to draw off the water.

*Aftertreatment* centers on the sinus, pocket or fistula always after the urethritis is cured and the infiltration resorbed as much as possible. The foregoing surgical lines are indicated. Stricture requires dilatation by mechanical or electrical methods as detailed in Chapter VII on the Treatment of Stricture on page 375. In all cases gentle measures applied at long sittings and rather rare intervals are the preference.

*Cure* requires relief of the abscess and its infectiousness and if possible restoration of the mucosa, with the least amount of deformity, therefore surgical methods should be judiciously performed.

### LYMPHANGITIS AND LYMPHADENITIS.

**Anatomy.**—The lymphatics of the penis are according to Quain<sup>1</sup> a dense network on the skin of glans and prepuce and beneath the mucosa of the urethra, and pass chiefly into the inguinal glands. A deep system issues from the cavernous and spongy body, passes with the deep veins under the pubic arch and joins the lymphatic plexuses of the pelvis.

**Significance.**—These two complications are one, as neither can exist without the other in certain degree. Acute infection of lymph-vessels and lymphglands is in gonococcal acute urethritis without mixed pyogenic infection rather rare on the one hand, but on the other hand if balanoposthitis with phimosis or paraphimosis is present such lymphatic involvement becomes much more common. Free suppuration and abscess is not a common eventuality in the glands.

**Symptoms.**—Subjective and objective symptoms are pain and tenderness along the lymphatic trunks and over the glands and in the tissue if cellulitis is imminent. Often red streaks pass up the penis marking the dorsolateral position of the trunks or there may be a general redness

<sup>1</sup> Quain's Anatomy, 1896, iii, Part 4, p. 243.

due to the cellulitis. The glands are often enlarged, tender and tense and may resolve or go on to suppuration marked by fluctuation and adhesion, infiltration and edema of the skin over the gland.

**Diagnosis.**—The anatomical features have been sufficiently detailed in Chapter II on Complications of Acute Urethritis, on page 104. Acute lymphangitis and lymphadenitis in the history are those of acute processes, with pain along the penis and in the groin on one or both sides. Examination often reveals red, hot, cord-like, tender streaks passing lengthwise of the organ and traceable into the glands of the groins which in their turn also become enlarged, hot, tender and sometimes adherent to the skin, tense, very painful and finally fluctuating if abscess appears.

Laboratory investigation demonstrates the gonococcus or other organism in the initial infection and may by aspiration with a fine needle recover the same from the affected glands. Treatment directed to the origin of the infection may by prompt and appropriate results give still further proof of the underlying infection.

**Chronic Lymphangitis and Lymphadenitis.**—Chronic lymphangitis and lymphadenitis are seen occasionally. The former with relation to urethritis seems rare, although the latter may occur in the strict sense. What is seen much more commonly is a number of acute attacks followed by infiltration of the glands and sometimes of the channels.

**Treatment of Gonococcal Acute and Chronic Lymphangitis and Lymphadenitis.**—Their significance is major only when very severe with inguinal abscess, and prevention is attention to the foreskin to avoid excoriations and ulcerations of balanoposthitis by early and efficient treatment, because such breaks in the surface become the foci of absorption into the lymphatics. If such portals of infection are open prevention is difficult against vicious forms of invasion so that the complication is rarely present in the absence of lesions on the surface and of abscesses within the urethra. The only abortion is the wet dressing with hot penile baths of antiseptics—alum acetate or bichloride of mercury 1 in 5000 changed every two hours, but it usually fails.

**Curative Treatment.**—The management in acute cases requires good hygiene, complete rest until the redness and tension are decreasing and suitable diet and drink to allay the irritation. Preputial irrigations for cleansing and antiseptics and hot penile and sitting baths as sedatives and antiphlogistics begin the physical measures.

Heliotherapy with the therapeutic lamp must produce great redness of the skin, but no pain when applied several times a day for from ten to thirty minutes by the patient himself up to the limit of his comfort.

Medicinal measures introduce the care of the urethritis and balanoposthitis as underlying sources of the lymphatic involvement as described under the heading of anatomy in the clinical paragraphs on this subject. The preputial irrigations and hand injections are continued and perhaps increased combined with wet dressings exactly as noted in balanoposthitis. In the chronic cases the glands are more apt to be involved but the treatment of chronic phimosis and balano-

posthitis tends to reduce the amount of absorption by healing the foci. Operative surgery incises and drains the abscess of the inguinal glands or if the suppuration is extensive removes them entirely. Dressings of the wounds are on common surgical lines. A single gland in the earliest stage of suppuration may be drained of its contained pus by aspiration followed by the injection of 10 per cent. iodoform in sterilized glycerin only up to filling and not distention of the cavity. Circumcision must not be forgotten as prevention of subsequent attacks and of extension of chronic cases to suppuration.

*Aftertreatment* avoids a relapse by the toilet of the foreskin during the remainder of the urethritis in irrigation, hand injection, lavage and dressings. Proper treatment of the urethritis may check complications of pus foci along the urethra, leading to a relapse. Circumcision is, as stated, the proper step in all cases.

*Cure* requires no active infiltrations or foci in the foreskin, urethra, lymphatic vessels or glands, and full bacteriologic proof of no infectiousness.

#### GLANDULAR COMPLICATIONS.

**Varieties and Importance.**—Any and all glands of the anterior urethra may be involved in gonococcal infection as a complication of the urethral invasion. This pathological fact therefore concerns the tubercular alveolar subepithelial, the simple depression, the submucous glands and finally Cowper's glands. In all the ducts may be patent, resulting in suppuration, with free discharge upon the surface or closed, causing retention of exudate and abscess formation, which may rupture externally upon the skin or internally into the urethra, leaving behind a cavity, sinus or fistula, of size and importance according to the gland affected and the extent of the secondary conditions. Cowper's glands are most important in this respect.

The great number of small urethral glands and the acknowledged frequency of their invasion and the relative absence of subjective symptoms, except in retention cases, make these complications among the most important, insidious and dangerous of the disease through tendency to harbor chronic infection.

#### LITTRITIS AND FOLLICULITIS.

**Varieties.**—The small mucous glands have often infection of two varieties, without retention of pus, called littritis and with retention of pus, termed folliculitis. The cause is intense infection, lowered local and systemic resistance and traumatism of faulty instrumentation or other local treatment, such as instillation, irrigation or application.

**Pathology.**—The pathology of littritis is briefly a migration of the gonococcus into the gland, and its same penetrating destructive infection as on the urethral surface, with pus usually in slugs through its temporary thickening within the cavity of the gland. The wall of the gland becomes thickened, so that on objective examination they may be felt as little shot-like nodes or granules scattered along the urethra.

higher grade of littritis, that is to say, folliculitis, adds only retention of the pus in abscesses with thick walls and final rupture into the urethra. The pathology of folliculitis continues the latter process and the wall of the glands and is therefore a periglandular and perithread process, with retention, abscess and rupture either into the urethra or upon the skin. The termination of these glandular complications is usually destruction of the function of the gland and anatomical obliteration of its cavity. More frequently chronic urethral inflammation follows with or without persistence of the gonococci. Pus-bearing and urine-bearing sinuses and fistulæ upon the skin are seen.



FIG. 20.—Gonococcal glandular periurethritis or folliculitis. (Legueu.<sup>1</sup>)

**Symptoms.**—Subjective symptoms of littritis are usually not noticed, while those of folliculitis may be swelling and deformity of the urethra, usually along the floor, presenting in variable size, externally to that of a cherry, and in different degree internally, to cause partial obstruction to urination. The objective symptoms of littritis may be absent, the nodules along the floor and sides of the urethra whose palpation is easy and commonly followed by expressed pus; while those of folliculitis establish the abscess or its secondary purulent or urinary sinus or fistula. The termination is sufficiently described under pathology in the preceding paragraphs.

**Diagnosis.**—As already discussed on pages 106–108, acute littritis and folliculitis are extensions of each other, the folliculitis being more severe than the littritis. In general the persistence of a gonococcal urethritis through a longer subacute stage than usual suggests the presence of littritis. The history is mild in littritis, more severe in folliculitis, especially in the declining period, when much more discharge in heavy shreds is present. Symptoms include a little pain and little noticed subjectively and nodules with little shot-like masses

<sup>1</sup> *Traité Chirurgical d'Urologie*, 1910.

along the urethra objectively, especially if an instrument is in the urethra against which the palpation is made. Urethroscopy will find individual follicles in various degrees of inflammation and recovery.

**Chronic Littritis and Folliculitis** arise from the acute lesions during a severe or several repeated attacks recognized by the foregoing diagnostic details. The history shows shred and drop never absent from the urethra or urine and the symptoms are those of acute attacks simulating the original acute disease or of the chronic conditions of discharge, pasted meatus and shreds. Nodes of infiltration, with expression of pus, are apparent and the multiple glass test will show whether the folliculitis is of the anterior, posterior or anteroposterior distribution, fully verified by the urethroscope. Shreds should be recovered and sent to the laboratory for identification of origin and bacteriology. Laboratory findings demonstrate the gonococcus in the slugs and shreds in the urine as passed and in sterile irrigating fluid after massage of the urethra. Treatment directed in general toward the gonococcal infection removes all discharge except the slugs of pus whose characteristics aid in the diagnosis. Urethroscopic applications of astringents, caustics, electricity and lancet remove individual foci.

**Treatment of Gonococcal Acute and Chronic Littritis and Folliculitis.**—Their significance as sources of infection is practically major in potentiality and prevention in the acute stages notes dilute solutions and conservative methods only in the declining period of the urethritis, which tends to avoid driving the infection into the follicles by the injury of traumatic dilatation with a stream under pressure. There is no abortive treatment, because the symptoms are hidden by those of the urethritis and the nature of the lesion is an insurmountable obstacle.

*Curative Treatment.*—The indications require respect.

Curative treatment in the acute stages which usually are those of an intense urethritis with only the usual management of hygiene, requires rest in bed until the symptoms begin to decrease and great attention to diet and drink. When folliculitis is apparent in the form of nodules or tender points all irrigation and hand injections should be temporarily suspended. In the physical measures, with a sound in the urethra only during the chronic stages, massage may be gently employed to stimulate evacuation and resorption while hot penile and sitting bath reduce the edema and the obstruction. Electrotherapy is of value only in the late declining and chronic periods in the form of cataphoresis against indolent nonbacterial discharge and in the form of high potential vacuum electrode attached to the negative pole of the standard multiple plate high-speed static machine. Medicinal measures are directed against the fever and absorption if present through systemic administration in marked cases. Serumtherapy is excellent in some individuals, as described in Chapter IX on page 51 the serum tending to establish passive immunity and bacterins excite active immunity. Locally, in the acute stages, all intraurethral treatment is stopped until the decline is well established, when it



resumed, at first with gentle means and later with slow augmentation determined by reaction. The expectant method is by all means preferred as irrigations under high pressure only increase the pathological lesions. When chronic manifestations appear the urethroscope is indicated for applications of caustics and the high-frequency current of Oudin, and x-ray vacuum glass electrodes, with static electricity, as already shown to destroy lurking infection and finally incision with the knife as required.

Nonoperative surgical treatment in the acute stages are wet dressings to allay suffering, swelling, edema and obstruction, which may be relieved by cautious catheterization with the soft-rubber instrument. Later on soft sounds or hot or cold straight steel sounds, with gentle massage and instillations of slowly ascending solutions of nitrate of silver, from 1 in 20,000 to 1 in 100, with the soft-rubber catheter or with the Bangs syringe sound, also with massage, are of great benefit. The author's irrigating sound in affording a retrojection as well as gentle dilatation should be used. Operative means reach the blind abscess by incision through the urethroscope while sinuses and fistulæ are opened upon a sound and dissected out or tied off exactly as detailed in periurethral abscess while contractures of the canal are dilated gently and gradually or divided according to indications.

*Aftertreatment.*—Aftertreatment is concerned with relief of the urethritis from which relapse may appear in the follicles, and with dilatation of stenoses with soft instruments during the early development and steel sounds when the mucosa is dry. A study of shreds in the urine is the guide of cure along with the author's multiple glass test.

*Cure.*—The little pockets should be free of infection even if not without their drop and the larger abscesses should follow the same course. Folliculitis is therefore one of the problems in urethritis and is on the border-line between minor and major complications. The most careful bacteriology is required to prove the cure. Some cases have a positive gonococcal complement fixation test.

### COWPERITIS.

*Varieties.*—As in the infections of most glands with ducts the outlets of Cowper's glands may or may not become occluded and thus arise the two forms, cowperitis without retention and cowperitis with retention.

*Occurrence.*—Like the small mucous glands of the urethra, Cowper's glands may be the subject of acute complicating involvement of treacherous, persistently infectious character. The occurrence is not common compared with littritis and folliculitis, but the clinical significance on account of the long, tortuous ducts and compound body of the glands is after their involvement far-reaching. The onset of the infection is after acute urethritis has involved the entire anterior urethra in full establishment; that is, about three or four weeks after the initial

invasion. Usually one, occasionally both glands simultaneously, are attacked with an insidious invasion exactly like the urethritis itself with at first relatively few subjective symptoms. The varieties are



FIG. 21.—Protective dressing for rectal examination. A rubber finger cot is placed on the index finger and over it is slipped several layers of gauze, about six inches square with a hole at the center rather tight for passage of the finger. The gauze receives any fecal or infectious matter from within or without the anus.



FIG. 22.—Is rectal examination, with the index finger of the gloved hand lubricated and passed into the rectum, with the fingers folded into the palm and the elbow supported by the hip for force in penetration, leaving the hand flaccid for palpation.

two, determined by the patency or occlusion of the duct—namely, without retention and with retention.

**Pathology.**—The lesions duplicate those found in and described for folliculitis in all details of the forms with and without retention, except that in the case of Cowper's glands organs of anatomical instead of histological proportions are involved.

**Symptoms.**—*Cowperitis without Retention.*—This form occurs the more commonly and is marked by freedom of the ducts to discharge the pus, actively under muscular action or passively under the examining finger. The symptoms are increasing swelling, pain and inter-



FIG. 23.—Is palpation of Cowper's glands; with the right index finger in the rectum the gland is pushed down against and between two fingers of the left hand, which permits thorough digital investigation.

mittent discharge, followed by decrease in the pain and enlargement temporarily until refilling of the gland occurs. The termination is least frequently complete resolution, but more commonly permanent damage or chronic disease of the gland.

*Cowperitis with Retention.*—This type occurs rather infrequently and is really abscess of Cowper's glands, characterized by closure of the ducts, retention of the pus, destruction of the gland, extension of the process into the surrounding tissues and final rupture, either upon the skin or into the urethra. At no time is active or passive evacuation of the pus possible and the gland is always damaged beyond future function and often beyond anatomical identity. The abscess is essentially acute, while the outcome in pocket, sinus, purulent or



urinary fistula is chronic. The symptoms are pain of heavy then acute progressing type in the perineum, accompanied by enlargement of the gland, with later heat, redness, tenderness, fixation and thinning of the skin and terminally with rupture and evacuation, externally upon the skin or internally into the canal, which is followed by pocket, sinus or fistula formation.

**Diagnosis.**—It is important to distinguish the two forms.

*Acute cowperitis without retention* appears during a long, severe urethritis, as to its history, with a tendency toward other glandular involvements such as folliculitis, and prostatitis. Posterior urethritis is a feature although Cowper's glands are at the bulb of the urethra and therefore in the anterior urethra, but the infection is extensive. The symptoms are severe pain in the perineum, with enlargement and abscess, intraurethral rupture through its own duct and persistent evacuation. Examination before evacuation is that of abscess and after evacuation that of a sac which empties under pressure. Rectal examination against a soft bougie in the anterior urethra will develop the position of the gland and its connection with the urethra. After cleansing the urethra a laboratory specimen may be obtained by pressure on the gland or through a urethroscope one may be secured with a swab or before evacuation aspiration with a fine needle is possible through the perineum. Treatment through relief of the urethritis may also subside the cowperitis and add to the evidence. Massage of the gland and in persistent cases incision and drainage fix the identity of the condition.

*Acute cowperitis with retention* is strictly abscess and essentially augments all the difficulties and symptoms. In addition to the foregoing facts we have rupture intraurethrally or extraurethrally at almost any point with sinus formation in which a probe may touch an instrument in the urethra. Surgical exploration settles the matter and distinguishes it from other abscesses in the perineum.

**Chronic Cowperitis Without and With Retention** is common on account of complexity of the gland and length and tortuosity of the duct. The history is that of acute invasion without recovery or with seeming recovery associated with relapses and the symptoms are those of more or less constant indolent discharge in the type without retention associated with discomfort or consciousness of the gland or those of acute or subacute relapsing abscess. The infiltrated mass of gland and duct is apparent with sudden expression of much pus in each form. The urethroscope is of final diagnostic aid.

**Treatment of Gonococcal Acute and Chronic Cowperitis.**—Their significance is major in cowperitis on account of complexity of the gland, severity of many cases and foci of chronic infection which the gland often become, and prophylaxis is as against other complications, as in the treatment of the gonococcal acute urethritis in regard to the stages of this process and to observation of the earliest signs of glandular involvement. Abortion is impossible because the glands have long ducts and complicated acini, so that when infection has once penetrated it cannot be eliminated in this manner.

*Curative treatment* during the acute period consists in the approved management of hygiene, rest in bed up to full subsidence and proper diet and drink, with due sexual rest. In the chronic form nothing irritating must be done, including sexual activity.

The physical measures in the acute stage are dangerous. In the chronic stage massage is of benefit in evacuating the gland and in promoting resolution. Hot rectal irrigations, sitting baths and body baths in hydrotherapy are quieting in the acute stage and tend to relieve the kidneys. The psychrophore is a sedative while leeches in extreme cases decrease the congestion. Light applied from a 60-candle power lamp in a small parabolic reflector for half an hour to an hour up to the tolerance of the patient for heat and actinic effects will relieve the pain and quiet the inflammation.

The electrotherapy is forbidden by acute inflammation but acceptable in declining and chronic periods either with or without occlusion. It stimulates the evacuation of pus, the destruction of infection and the restoration of the infiltration. When infection has nearly or fully disappeared, galvanic cataphoresis with a small electrode wound with cotton soaked in weak solutions of zinc chloride or copper sulphate and attached to the positive pole or in one-tenth to one-fourth strength of the tincture of iodine and connected with the negative pole may be used in 3 to 5 milliampères of current for five to ten minutes every three to five days. There should be no reaction and only benefit. If infection is present then the x-ray vacuum glass electrodes attached to the negative pole of a standard high-speed multiple plate static machine is used, with intensity of current of a spark gap one-half to one and a half inches for five or ten minutes every three to five days, likewise always with benefit and without excitation. Its strong actinic and germicidal effects are thus localized upon the glands. Experimentally the actinic effects penetrate to a depth of from 2 to 6 mm., depending on the intensity of current employed.

Medical measures are in the acute period little or none. Locally all hand injections and irrigations should be stopped and only external applications by the physical means adopted, including wet dressings of lead and opium wash for the pain and of lead water, acetate of aluminum and weak bichloride of mercury for their antiseptics. In the chronic stages the irrigations of the urethra and instillations as described for anterior and posterior chronic urethritis may heal the urethra overlying the gland, but are without effect on the cavity of the gland, likewise applications through the urethroscope. Systemically the measures previously described against the absorptive conditions are again used.

Nonoperative surgical means are contraindicated in the acute and cautiously begun and judiciously progressed in the chronic period. The author's irrigating sound is of advantage in cowperitis without occlusion and combined gentle dilatation, with retrojection of the urethra and irrigation of the bladder against possible infection. Abscess contraindicates sounds until incision and drainage relieve

the tension. Retention of urine in acute cases and in relapse chronic forms is catheterized with a small soft-rubber catheter with great gentleness.

Operative measures through the urethroscope on cowperitis without occlusion stimulate the mucosa overlying the gland while occluded gland must be incised and drained whether acute or chronic. Cyst formation in the latter forms is seen. The technic requires following instruments: The author's irrigating sound, one scalpel



FIG. 24.—Abscess of Cowper's gland. Left side, postoperative condition, showing position and direction of the incision. (Hayden.<sup>1</sup>)

one scissors, several small hemostats, ligatures, small sharp and blunt retractors, probe, director, small gauze drains, dressings and a gauze T-binder—almost duplicating those for external urethrotomy with guide. The preparation of the patient and the field is the accepted methods, while in chronic cases the anesthesia is local but in acute forms general. The posture is the exaggerated lithotomy while landmarks of the urethra are shown by the sound and of the gland by the finger in the rectum. The superficial field is the perineum between the anus and the scrotum in which the incision is made at the prominence of the swelling down to the surface of the gland. In the deep field, which is incised with scalpel and scissors to the length of the skin incision and gently probed for pockets and burrs which are broken into the main cavity with the blunt point of artery clamp. The cavity is gently wiped clean and packed with gauze under pressure on the urethra. The author's sound irrigates the bladder against infection and is then withdrawn and the T-binder is applied over the dressing.

<sup>1</sup> Venereal Diseases, 1916.

*Immediate aftertreatment* is dressing at regular intervals as needed, with renewal of drains on the third, fifth or seventh day, and balsam of Peru stimulating dressings. All packings and drainage are stopped as soon as possible and the dressing is made light simply to keep the skin open and avoid a sinus. The remote aftercare is the passing of sounds for the infiltration, massage and electricity for resorption and suitable applications through instillating sounds and the urethroscope for the bulbar urethritis.

*Cure.*—In the sense of restoring Cowper's glands to fully normal condition is very rare indeed in either the form without occlusion or that with occlusion of the duct. The large size of the gland and its complicated acini leave it a focus of disease even after the gonococci have disappeared, which is the chief standard of success. When this fails the complication is immediately major on account of the infection which remains years behind after symptoms have ceased. Cure in the sense of evacuating the pus and obliterating the gland is much more easy whether in the period of obstruction and abscess or in the occasional later period of cyst formation.

## 2. Urinary Forms.

Inasmuch as anterior urethritis does not reach the urinary organs above the pendulous part of the penis, there is no urinary group of complications arising during its course. This class of complication makes its first appearance during posterior urethritis, when that part of the canal in direct outlet of the bladder becomes involved. Their description will therefore be found under the subject of Complications of Posterior Urethritis on page 162.

## B. SYSTEMIC GROUP.

The general characters of the anterior urethra and its glands make septic absorption from it and systemic complications rare and difficult, but less so the posterior acute and anteroposterior acute lesions. Systemic complications are most common in chronic urethritis, under which heading they are more appropriately discussed.

Anterior chronic urethritis may during any exacerbation or under any exciting cause develop an acute complication. It is for this reason not easy to draw a fixed line of distinction between complications of acute and chronic disease. Both forms are so correlated and interwoven that both acute and chronic complications may be associated with or sequel to either acute or chronic urethritis.

## II. COMPLICATIONS OF POSTERIOR GONOCOCCAL ACUTE URETHRITIS.

**General Clinical Features.**—The complications of posterior acute urethritis have the same clinical peculiarities, independently of cause, just as do those of the anterior urethra. In discussing the latter

subject gonococcal infection was taken as the standard and will be again in connection with the present matter, because its type is the most unmistakable.

**Varieties.**—The general classes are local, affecting the urinary and sexual organs only, and systemic, reaching the body at large in particular systems or in general. The local or urogenital complications in anatomical order are the sexual: prostatitis, vesiculitis, funiculitis, epididymitis and orchitis; and the urinary: cystitis, retention of urine, ureteritis, pyelitis and pyelonephritis.

The systemic or extraurogenital group embraces cutaneous, digestive, circulatory (including metastatic abscesses), respiratory, special sensory and locomotor (including bone, articular, muscular and tenosynovial) complications, and are discussed in Chapter III on page 201.

There are no urinary or systemic complications of anterior acute urethritis, as stated in the introductory paragraphs of this section. These two groups are therefore properly considered under posterior urethral lesions.

#### A. UROGENITAL GROUP.

**Varieties.**—Two groups are recognized: sexual and urinary. Of these all not only may be acute complications during posterior gonococcal acute urethritis, also may be acute complications during exacerbations or during the ordinary course of posterior gonococcal chronic urethritis. The sexual group comprises prostatitis, seminal vesiculitis, funiculitis, epididymitis and orchitis. The last three are so closely related as to be considered usually under the one subject of epididymitis. The urinary group includes urethrocystitis, cystitis, retention of urine, ureteritis, pyelitis and pyelonephritis.

##### 1. *Sexual Forms.*

For the sake of convenience the anatomical order will be followed and the comparative frequency of occurrence will be noted under each example.

#### PROSTATITIS.

**Occurrence and Etiology.**—Infection of the prostate through its position and connection by ducts with the posterior urethra occurs as a very common complication of posterior acute urethritis or during an acute exacerbation of chronic disease or as an acute condition in the course of chronic urethritis, as will be later discussed. The exciting cause is direct extension in continuity of mucosa of severe infection with or without associated pus organisms. All-important predisposing factors are catarrhal prostatitis of venereal excess and masturbation, irritation by alcoholism and condiments and traumatism by faulty treatment and agitation by railroad, automobile, bicycle and horseback-riding. Varieties are acute, subacute and chronic, of which the last will be discussed as cognate with chronic urethritis in a later chapter.

**Gonococcal Acute Prostatitis.—Varieties.**—Acute complicating prostatitis shows two forms according to the portion of the gland involved, namely, follicular or glandular prostatitis, in which acini and ducts alone are involved, and parenchymatous or phlegmonous prostatitis (abscess of the prostate), in which the gland-tissue as a whole in one or more parts is destroyed.

**Pathology.**—*Acute follicular prostatitis* is that of mild congestion, with full recovery or that severe suppuration involving the ducts and the acini usually without retention so that the pus is evacuated spontaneously into the urethra. The acini and ducts may recover fully or be permanently damaged and obliterated or become the seats of chronic foci of infection.

*Subacute follicular prostatitis* has the same lesions as the acute type but in much milder degree, owing to the fact that it commonly arises through causes other than severe infection, such as exposure, vicious habits and faulty treatment. Chronic follicular prostatitis is usually the outcome of the more severe suppurative forms, but occasionally the subacute type also becomes chronic. Each follows the tendency of its own preliminary form in that the follicles chronically diseased continue either suppurative or catarrhal, as the case may have been at the outset. Suppurating follicles, however, may eventually lose their pus but retain their mucous discharge. This subject is further treated in the Chapter on Complications of Chronic Gonococcal Urethritis.

**Acute Parenchymatous Prostatitis.**—The abscess is mild, severe or intense in degree according to the activity, extent and complications of the lesions. It is caused by follicular infection, penetrated, extended and involved in the stroma as well as in the glandular elements of the prostate, with resulting abscess. In site, the abscess may be superficial or deep, in any lobe or lobes or in the gland as a whole, and may vary in number from single to multiple, with a tendency to coalesce into one common cavity, and may differ in size from that of peas to eggs containing from a few to 250 c.c. of pus. The contents may be pure pus or a mixture of detritus, pus and blood without odor or very foul from the presence of *Bacillus coli communis*. In termination the phlegmon evacuates according to its site and the periprostatic infection: (1) internally into the urethra, bladder, vesicorectal space, rectum and peritoneum, and (2) externally, usually upon the skin of the perineum. The complicating lesions of prostatic abscess are due to penetration into or association in the periprostatic spaces of the initial infection, with burrowing of the pus determined largely by the original sites: (1) backward into the rectum by abscesses originally near its cavity; (2) downward into the perineum, sheath of the penis or scrotum; (3) laterally into the ischiorectal fossæ and thigh, and (4) upward upon the loins and back. Pockets, sinuses and seminal, urinary or fecal fistulas are often the sequels of such complications.

**Symptoms.**—The symptoms of *acute follicular prostatitis* vary with the degree of the infection, being less in the superficial follicular and subacute cases and greater in the deeper follicular and parenchymatous



and acute forms. They are local and systemic, subjective and objective in distinction. The local subjective symptoms are (1) sensory: pain and weight in the perineum, rectum and bladder in the deep pelvis or referred down the thighs and into the loins much as uterine pain in the female, and (2) vesical: dysuria, pollakiuria, tenesmus through congestion and irritation, and retention of urine by edema or spasm; (3) sexual: chordée and painful, bloody, seminal emissions, and (4) rectal: pain in defecation, altered stools and obstipation, through mechanical pressure and tenesmus through reflex action or periprostatic invasion.

The local objective symptoms are urinary and rectal.

1. *Urinary Signs.*—All test-glasses of urine are filled with pus, but the last often with slugs of prostatic detritus and blood.

The seven-glass test of the author may be done with caution in the less severe cases. It will show large amounts of pus in the first three glasses. Only the fourth or bladder glass secured with the catheter will be free of abnormal constituents unless the bladder and other urinary organs are infected. If gentle massage of the prostate is made the fifth or massage glass will be loaded with the expressed contents of those follicles which have not been occluded. The sixth and seventh glasses are again negative if both seminal vesicles have escaped involvement. The technic of the seven-glass test is described in the Chapter on Posterior Chronic Urethritis on page 291. In the more severe cases the four-glass test is of much value. The prostatic products in the third or posterior urethral glass and in the fourth or prostatic massage glass make the diagnosis. Passage of catheters in these intense cases for a bladder specimen is contraindicated.

2. *Rectal Signs.*—Through the rectum: The prostate is hot, enlarged, tense, fluctuating at various points or in the whole body of the gland and tender, obstructing the rectum more or less completely and the periprostatic tissues may be boggy or infiltrated. Vesical and rectal tenesmus follow examination. Instrumental urethral examination is contraindicated except to relieve retention. The subjective and objective systemic symptoms are chill or chilliness, fever from 100° to 105° F., prostration, depression, nausea, vomiting, blood-count typical of active pus processes and willing confinement to bed for many days. Severe lesions cause extreme suffering, almost more than any other destructive pus condition in any organ. When the pus is actually present all symptoms are greatly augmented.

The termination is in mild cases always slow, but usually complete recovery. In the more severe cases follicles may be destroyed and obliterated or go on to chronic catarrhal or suppurative inflammation, which may last for years or life. The ducts of such follicles are patulous in the field of the urethroscope and often discharge clouds and slugs of pus while under observation.

*Subacute Follicular Prostatitis.*—This is very similar in kind but much less in degree and concerns primary and secondary cases. The primary cases are caused by the improper use of irrigations, injections,

atheters, sounds, urethrosopes, cystoscopes and lithotrites and the secondary cases arise during a posterior urethritis or after excesses in alcohol, food, coitus, masturbation and exercise. The termination is usually complete recovery after withdrawal of the cause, particularly improper medication and instrumentation.

*Acute Parenchymatous Prostatitis.*—This very important disease follows mild, severe and intense courses in accordance with the number, size and destructiveness of the abscesses and the complications. Pain in the prostate is severe, augmenting with the progress of the pus, throbbing and heavy in character, often referred along the penis and urethra and backward into the lumbar regions. Obstruction of the rectum is marked. The urinary symptoms are severe, scalding pollakiuria, dysuria, even drop by drop and retention by edema. The urethra is obstructed to the catheter even to 10 or 12 French and naturally deviates away from the point of greatest enlargement. The rectal symptoms are obstipation, stools compressed to "ribbons" or scybala and the gland greatly enlarged into the rectum as a general abscess or as multiple soft foci or a urethral submucous abscess, difficult to distinguish positively. The sexual symptoms are commonly wanting, owing to the pain which inhibits the spinal reflexes; but if present they are scalding, bloody, purulent emissions.

The systemic symptoms are those of intense pus focus anywhere in the body, with active absorption. Typhoid fever is not uncommonly wrongly suspected as present in these cases on account of their active septicemic condition and prostration and may be disproved only by the absence of the Widal reaction in the blood and the typhoid bacilli in the blood and excreta. The symptoms are therefore severe and often recurring chills rather than mere chilliness, fever of sudden appearance and wide variations, rapid high-tension pulse, profuse perspiration, depression and a septic exhausted appearance.

The termination is usually spontaneous or operative evacuation, with prompt positive decrease of all symptoms. Natural pointing of the pus is in the line of least resistance, and as described under Pathology may be devious and unexpected, leaving behind chronic pockets, sinuses and urinary, seminal or fecal fistulæ. Death from septicemia is rather common in neglected cases.

In general, infection of the prostate is a serious and long-continued condition, owing to the complexity and delicacy of the gland itself as shown in its embryological foundations and owing to its direct connection with the posterior urethra which is in itself so often the site of chronic infection.

**Diagnosis.**—It is essential to determine the form of prostatitis present.

*Acute and subacute follicular prostatitis* present intense invasion of the urethra, in their histories, with rapid extension into the posterior portion and with signs of vesical irritation, active and persistent. Subacute forms are the milder. Local symptoms are sensory, vesical, sexual and rectal, subjectively, with a tendency to focalize in the prostate, and objectively the multiple glass tests (without use of



catheter in the bladder) show the posterior urethral glass and the massage glass full of pus and prostatic elements through muscular action of the neck of the bladder and the urethra and by the compression of the massage. Through the rectum all signs of infection, infiltration and obstruction are present. Systemic symptoms are those of infection, fever, chill, prostration and blood count. For the laboratory a specimen may be obtained after gentle irrigation of the anterior urethra by massage followed by evacuation of the bladder, and will contain the gonococcus for smear and culture associated with many prostatic elements. This complication sometimes gives a positive complement fixation test early. Treatment by securing subsidence of the anteroposterior urethritis benefits the prostatitis indirectly, but direct treatment of the gland with massage, rectal irrigations and sometimes electrical applications proves the lesion.

*Acute parenchymatous prostatitis* duplicates and augments all the foregoing symptoms, and develops a large focus of pus in one or both lobes or the gland as a whole with characteristic symptoms. In all forms of acute prostatitis urethroscopy and other forms of instrumentation are contraindicated.

**Gonococcal Chronic Prostatitis.**—Differences in degree mark chronic catarrhal from chronic suppurative forms as their general character is much the same. The history marks the catarrhal cases as originating in diatheses, in indiscretions as to diet, drinking and sexual intercourse and in frequent attacks of urethritis which leave the simpler inflammation behind them without true suppurative prostatitis. The gonococcal prostatitis, however, have a record of one or more definite invasions of the organ, with follicular (less severe) or parenchymatous (more pronounced) manifestations. The subjective symptoms are therefore in definite or marked sensory, sexual, vesical and rectal disturbance. Leaking from the urethra during defecation contains mucus or pus according to the catarrhal or pyogenic lesions. The objective signs comprise the findings in the seven-glass test followed by laboratory examination and the conditions of the prostate on bimanual or unimanual examination. Catarrhal prostatitis gives universal softness, follicular prostatitis contains spots of softening, with purulent discharge and parenchymatous prostatitis has one or more large points of softening, due to abscess. The periurethral method consisting in passing a soft woven lisle thread or silk catheter into the bladder and examining the prostate around it should be employed only by those of great skill and caution in obscure cases.

As to the objective signs, Schlagintweit<sup>1</sup> states the following phenomenon: During massage of the prostate the patient holds below the meatus a tumbler filled with water, in order to catch the outflow of the secretion. Drops massaged out of the lower portions of the prostate in the immediate neighborhood of the anus fall from a height from 5 to 10 c.c. to the surface of the water, where they dissipate themselves in

<sup>1</sup> Nitze-Oberlaender's Centralblatt, 1901, p. 173.

so far as they consist in normal thin secretion of the gland. The result is a slight opalescence imparted to the water exactly like that seen in the urine after massage of the prostate. Those drops of the fluid expressed which contain pus sink to the bottom of the glass as thick flocculent masses. The drops, however, which are brought away from the upper part of the prostate, which have subsequently been shown to arise from the seminal vesicles, cling in formed condition to the upper level of the water and gradually elongate themselves, in accordance with their thickness and weight, into longer or shorter mollusk-like floating sacculi or vessels.

Oberlaender and Kollmann<sup>1</sup> say that the surest and safest diagnostic proof of prostatitis is the microscopic findings in the secretion expressed. Normal prostatic secretion consists chiefly of masses of lecithin kernels and scattered epithelial cells. The secretion of prostatitis contains in accordance with the severity of the inflammation admixture of pus with the normal fluid or consists of pure pus. Seminal crystals and amyloid bodies are not constant factors. Spermatozoa are found only when the seminal vesicles and the ejaculatory ducts are victims of the inflammation. The microscopic findings are shown in the normal secretion and of mild and severe inflammation of the glands. The laboratory analysis obtained by irrigation of the urethra, massage of the prostate and centrifugation of urine embraces bacteriology for the gonococcus and other organisms in sterile specimens and the gonococcal fixation test. The treatment usually involves easy distinction of the fact of prostatitis and of one form from another.

According to Young<sup>2</sup> the relation of leukocytes, pus cells, epithelia, spermatozoa and bacteria in expressed prostatitic fluid is the deciding factor. This contribution by Young is fully discussed on page 318, under the subject of chronic prostatitis as a complication of posterior chronic urethritis.

**Treatment of Gonococcal Acute and Chronic Prostatitis.**—With due regard to significance, this complication is distinctly major because it usually involves the gland deeply, may lead to absorption and rheumatism, and not infrequently to an important operation. The varieties of follicular and parenchymatous prostatitis are considered together because, like the symptoms, the treatment is usually one of differences in degree only and not in kind.

The prophylaxis is only concerned with the same measures of prevention available in all other complications of gonococcal disease, such as caution, care, conservatism and judgment in the treatment of the anteroposterior urethritis. Most important is the instrumentation of the urethra during the disease. In doubt it had best be omitted. Likewise the physical methods especially massage and electrotherapy if begun too early and carried on improperly may induce a follicular or parenchymatous involvement otherwise avoidable. Abortion in the

<sup>1</sup> Die chronische Gonorrhoe der männlichen Harnröhre, Zweite Auflage, 1910.

<sup>2</sup> Johns Hopkins Hospital Reports, No. xiii.

strict sense cannot be accomplished because the symptoms of prostatitis merge indefinitely with those of the urethritis.

*Curative Treatment.*—All measures are founded on interpretation indications and proper choice and application of the various measures at command.

The essentials of management are described in Chapter IX, page 483, on General Principles of Treatment.

Of physical measures in acute follicular prostatitis massage is contraindicated, but in the subacute stages is valuable and in the chronic stages is advisable for emptying the acini of pus and thus giving the restorative impulse. In parenchymatous prostatitis massage is dangerous—by extending the abscess through trauma. A chronic abscess with sinus, while awaiting operation, may be temporarily benefited by



FIG. 25.—Rectal examination of the prostate. The patient is in the knee or knee-chest posture on the table. The elbow of the examiner rests on the side of hip and body gently presses the hand deeply into the perineum while the finger is relaxed free of strain to make the exploration of the prostate gland, seminal vesicles and bladder.

judicious evacuation and absorption from it thus limited. Massage is best performed with the bladder full and the patient stooping over a chair or table. The well lubricated glove index finger is inserted into the rectum while the forearm is supported by the hip for penetration (Fig. 25). The ducts of the gland radiate more or less in an ordered manner from the colliculus and the prostatic fosses. All pressures should therefore be exerted from the lateral borders toward the urethra and the author begins at the lateral border and at the base of the gland and then steadily passes his finger toward the urethra along the upper border, then on the same side a centimeter in front of the first zone, then a similar distance in front of the second zone until the apex of the gland is reached. Thus one lateral half is completely evacuated and the second lateral half of the gland is treated in exactly the same



manner. Thus the anatomical structure is carefully respected and the normal physiology reasonably imitated.

The hydrotherapy, locally, during the acute period forbids all urethral and vesical irrigation unless acute retention of urine shall have made the gentle passing of a small soft rubber catheter necessary. While the catheter is *in situ* the bladder should be protected against infection by irrigation. Rectal lavage with hot water through the double current tube and with hot or cold water through the psychrophore and the ice-bag to the perineum with protection of the testicles against the cold and to the suprapubic region are comforting. Very hot sitting baths and leeches directly decongest the deep pelvic circulation. All these measures quiet the hyperemia and disturbance and thus reduce the pain, irritability, reflex symptoms of the acute and subacute periods but are of little value in the chronic stages. General hydrotherapy is of little importance in the acute period but otherwise in the subacute and especially in the chronic stages. Bodily baths and Turkish baths aid in elimination of the septic absorption so often seen in the recovery after operation.

The application of light through its heat and in actinic power in acute onset will decrease the pain and in the chronic stages aid in resorption. It requires prolonged application by the patient or attendant several times a day and will aid the other methods, but is of itself not sufficient. Its convenience of use makes it more attractive than hydrotherapy.

The electrotherapy is obviously impossible in the acute period, but is applicable during the late subacute and chronic stages. Its local means are chiefly rectal by the high vacuum glass electrode, attached to the negative pole of a standard multiple plate, high-speed, static, electrical machine for its powerful actinic and mild x-ray effects. In persistent infection the spark gap is from one-half to one and a half inches for the intensity of the current, five to ten minutes are the duration, and every other day at first and then longer intervals are the frequency. When the infection is cured the static wave current is applied through the metal electrodes, attached to the positive pole of the same static machine, with a spark gap of from one inch to six inches for intensity, according to the resistance of the patient, with twenty minutes as the limit of duration, and with alternate days as the early and longer intervals as the later frequency. Easy count of the interruptions by the spark gap is the standard. Thus are gained alternate physiological tissue contraction and relaxation in a way that is not possible with the finger in massage. Electrolysis through galvanism is the only way in which this modality may be applied to the deep urethra with the copper or silver tip electrodes. Intensity is from 3 to 5 milliampères, five to ten minutes are the duration and every other day is the early frequency followed by more extended intervals. The positive pole is attached to the electrode and the current induces a deposit of the metal in the tissues. The current should be turned off before the electrode is removed, and if there seems to be spasm or adhesion the polarity should be reversed, either

or both difficulties are corrected by loosening of the electrode. *Cataphoresis* cannot be carried on in the deep urethra because an electrode wound with cotton cannot be introduced there. High-frequency current of Oudin is applied to individual follicles in the chronic period through the urethroscope as detailed under that subject.

The systemic electrotherapy is available for stimulating elimination, digestion, circulation and the nervous system as discussed under the paragraphs devoted to systemic application in the electrical treatment of acute urethritis on page 281.

Medicinal measures are of little avail in the acute or in the chronic stages by systemic administration. Sedatives are required for the pain in the form of opium suppositories, codein by mouth and hypodermic injections of morphin for the urinary disturbance through dilution and neutrality of the urine by drinking water and any of the standard prescriptions already stated, and for the sexual irritation by instruction to keep the bladder and the rectum empty. The pollakiuria always keeps the bladder empty in the acute stages, but in the chronic periods such directions are necessary. The rectal distress is aided by the foregoing measures. The serotherapy may be tried in the acute and avails in some cases, but fails in many, and is not in gonococcal disease the magical relief which it is in diphtheria, for example. In general, the serum tends to promote passive immunity in acute conditions and the bacterin to establish active immunity. The latter preparation may be autogenous or heterogeneous and is of more service in the chronic absorptive conditions, but by no means invariably so. Persistent use with other means secures success, and the negative phase must be avoided as detailed in Chapter IX on General Principles of Treatment in the section on Serumtherapy on page 512.

The mixed bacterin of Van Cott is often very serviceable in cases having the mixed infection and active absorption.

The local administrations are omitted during acute follicular prostatitis as all invasion of the posterior urethra must be abandoned until the declining period is well established. Irrigation of the bladder after catheterization for acute retention and retrojection of the urethra, with the antiseptic contents of the bladder as part of this process, is an exception of this rule. Instillations, at first with the soft-rubber catheter and later with the Bangs syringe sound or the Keyes-Ultzmann syringe, with very dilute and then slowly ascending standard solutions, are valuable, but often reach only the surface of the mucosa and not the depths of the follicles. They may be called "blanket applications" in covering a large area without definite localization or penetration. Later in the chronic stage, applications of astringents and antiseptics to individual follicles through the urethroscope are good, as discussed under this subject.

In the acute and chronic parenchymatous prostatitis local medication is practically fruitless, because the abscess is deep under the mucosa beyond their reach.

Nonoperative surgical measures are advisable and serviceable.

*Acute Follicular Prostatitis.*—For retention of urine, catheterization is foremost, with a soft-rubber catheter, which should be tied in order to avoid frequent invasion of the viscus. In the later chronic period instillations and retrojections, as already discussed, are noted. The author's irrigating sound is of special service when dilatation becomes indicated, because it combines retrojection with it at one passage of the instrument. Similarly the Bangs instillating sound may be used for focal medication and for mild massage, with the instrument in place, but only in chronic follicular cases. The Kollmann irrigating and nonirrigating dilators are also available, but only with the greatest possible gentleness and in the latest period of the disease always without any reactions.

*Parenchymatous Prostatitis.*—All these methods are of avail only in the postoperative stage, when the chronic urethritis associated with the prostatitis requires treatment of the mucosa.

*Operative Procedures.*—These are chiefly urethroscopic measures and open operation.

*Chronic Follicular Prostatitis.*—The operative steps in this lesion are chiefly applications through the urethroscope of astringents and caustics to the mucosa, the high-frequency current of Oudin and evacuation by incision with the long scalpel of individual acini. Instillations through long needles attached to a hypodermic barrel may be tried.

The chief field of operation is in acute parenchymatous prostatitis having one or more distinct abscesses or an old abscess either with chronic discharge or frequent relapses of acute attacks with repeated rupture into the urethra or even externally.

The technic of operation is simple for cases with pus present to the examining finger by the enlargement, tension or fluctuation, or with pus indicated by severe absorption closely simulating typhoid fever, with which they are sometimes confounded during the first few days. Equipment is the same as in external urethrotomy with a guide, and the preparation of the patient is that usual for any major operation and of the field by any recognized method, of which none is better than tincture of iodine, provided the scrotum is not thickly coated. Anesthesia is by choice general on account of the uncertainties of the deep dissection, but may be spinal in occasional cases, and rarely local because the inflammation makes the instillation so painful. Posture is exaggerated lithotomy and general landmarks are the rectum behind, base of scrotum in front, with its raphé, the tuberosities of the ischia and the urethra made prominent by the author's irrigating sound. The incision should leave the urethra intact and be made over the prominence of the swelling in unilateral cases and over each swelling in bilateral, discrete cases, exactly as in bilateral cowperitis and over the abscess as a whole in bilateral confluent cases. Its form may be straight and oblique, horizontal or curvilinear, as in perineal prosta-tectomy. The horizontal incision is to be preferred when possible because it most conserves the muscular structures of the perineum, zapes longest for drainage and is in general parallel with the prostatic

ducts. The superficial field is the perineal skin, fat and fascia and avoids the muscles as far as possible by blunt dissection to the lower surface of the gland, which is the deep field. If pus is not apparent to the finger an aspirating needle will locate it, upon which as a guide the straight blade sharp point bistoury is entered and the prostate divided to the limit of the skin incision. The finger in the wound now explores the cavity of the gland for other foci and gently breaks them into the main pocket. The rounded tip of a velvet eye catheter is passed into the wound for irrigation and stitched to the skin for drainage combined with one or more cigarette drains which with external dressing and a good T-binder still all hemorrhage. No suture of the wound should be necessary. If no pus is located free incision is warranted as a relief of hyperemia and absorption. Pus will appear in such a wound quite regularly after a day or two.

The disapproved methods are puncture of the abscess, with trocar and cannula, through either the perineum or the rectum, because neither route nor instrument gives adequate drainage, and the rectum becomes infected with the gonococcus and the abscess, with the flora of the bowel, notably the *Bacillus coli communis*.

*Immediate Aftertreatment.*—Irrigation of the bladder is advisable through the author's tunneled and grooved sound, used as a guide before its removal, and observation and change of the dressing for undue drainage or oozing, and remote aftercare is removal of the drainage tube in from three to five days and of the cigarette drains in from five to ten days when the patient begins to get up. Standard nursing and diet are the rule. When the wound has practically healed, cautious attention to the posterior urethritis should be begun and prosecuted with great judgment in order not to offend the recovering gland again.

*Cure.*—Cure is not possible for entire restitution in the pathological sense, but relief from all symptoms and restoration to nearly normal physiology is usual in the symptomatic aspect. Return of the urethral mucosa to absolute normal probably rarely occurs. Perhaps most important of all is relief from infectiousness in both the follicular and the parenchymatous forms, thus constituting bacteriological cure—a most important sociologic matter, because the prostate is copiously and directly related with the production of the semen.

### **SEMINAL VESICULITIS OR SPERMATOCYSTITIS.**

*Occurrence.*—Infection or affection of the seminal vesicles as a complication of any urethral condition is a rare occurrence except in posterior suppurative and especially posterior gonococcal urethritis of which the latter is taken as the type.

*Etiology.*—It may appear during acute disease or during an exacerbation of chronic disease or simply in the course of the latter, induced by an exciting cause. Seminal vesiculitis has as exciting causes direct extension of infection by the gonococcus from a posterior urethriti



through the ejaculatory ducts as they emerge through the colliculus seminalis nearly at the midpoint of the prostatic urethra. The predisposing causes are lowered local resistance through other forms of urethritis, notably catarrhal and diathetic lesions, through congestion of masturbation and venereal and dietetic excess, and through inflammation augmented by traumatism from catheters, sounds, urethroscopes, instillations, irrigations and the like. The most potent contributing cause is coitus or masturbation during a posterior gonococcal chronic urethritis.

**Varieties.**—Seminal vesiculitis is recognized under the following forms, primary and secondary as to occurrence; unilateral and bilateral as to situation; acute, subacute and chronic as to course; catarrhal, suppurative, gonococcal and tuberculous and with and without occlusion of the ducts, as to pathology. Chronic seminal vesiculitis belongs to the general subject of chronic disease in later chapters on page 318.

The primary seminal vesiculitis is of very rare occurrence, except in tuberculosis, with which this work is not directly concerned except mention and differentiation. On the other hand the secondary seminal vesiculitis is very common, associated with and complicating posterior gonococcal urethritis. The catarrhal form and the suppurative form are more commonly the terminal stage of the gonococcal condition than essential lesions. As in all other glandular complications of gonococcal origin the ducts may be occluded or not leading respectively to abscess formation or severe infection, with constant drainage of pus into the urethra. Any form of spermatoecystitis may be unilateral or bilateral, with a tendency toward double involvement, with one vesicle the more actively diseased.

**Pathology.**—*Acute Spermatoecystitis.*—Acute spermatoecystitis without retention is in essence a gonococcal invasion of the seminal bladder, with a stage of invasion, establishment and termination, exactly as in urethritis. The cavity of the vesicle after the congestive lesions of the invasion are over is filled with pus containing desquamated epithelium, blood, pus cells and other detritus. At some points the process is deeper than elsewhere. After temporary distention the contents are evacuated into the urethra and the process renews itself. The whole process may be temporary or in part permanent, respectively with full or partial recovery.

The pathology of *acute spermatoecystitis with retention* is that of a localized abscess, more or less destroying the seed sac as a whole and extending frequently into the surrounding tissues and pointing in almost any direction, downward through the perineum to the skin, forward into the urinary bladder, backward into the rectum and upward into the peritoneal cavity as a rare occurrence.

The pathology of *chronic spermatoecystitis* depends on the initial variety. If there has been no retention the chronic inflammatory changes in the gland and its duct continue with persistent or relapsing discharge. The gland is often converted into an indolent pocket, in



of prostatic elements, provided the prostate is little or not affected and the vesicles predominately or solely involved.

The systemic, subjective and objective symptoms of acute spermato-cystitis without retention are similar to those in prostatitis: chill or chilliness, fever from 100° to 105° F., malaise, nausea and vomiting, depression, prostration and loss of sleep. A feature of this complication is a tendency toward absorption, leading especially to arthritic and allied conditions, so that one might clinically say that there are two types: cases with absorption and cases without absorption. The fever is, moreover, apt to be of the so-called urinary or urethral type, easily provoked by examination of the vesicles, suddenly showing great height, delirium, anuria and prostration. It is therefore important to proceed with the greatest possible gentleness in the objective examination.

The symptomatology of *subacute spermato-cystitis without retention* duplicates the foregoing description in kind but much less in degree.

The symptom-complex of *acute seminal vesiculitis with retention*, otherwise called abscess of the seminal vesicles, augments all the foregoing conditions and adds the presence of the abscess itself, which may involve the seed sac alone or the surrounding structures also, leading to more or less total destruction of the organ and penetration of the pus as set forth under the subject of pathology. Each such sequel has its own obvious train of symptoms, due to the pocket, sinus or fistula left behind, either seminal, urinary or fecal. Abscess of the seminal vesicle is always the source of the absorptive conditions previously spoken of. It has another peculiar feature in that pressure of the abscess may obstruct the ureter and cause distinct symptoms of colic. This is more apt to be the cause of renal colic than is the drainage of the seminal vesicle contents spoken of by Reliquet.<sup>1</sup>

The termination of all forms of acute seminal vesiculitis begins usually in one or two weeks after full establishment. Recovery and resolution occur in mild cases, much damage rather than little damage is seen in severe cases and total destruction in abscesses of the sacs. Both sides are usually involved, of which one may recover and the other not or both be damaged the one more deeply than its fellow. The burrowing of pus in abscesses with perivesicular complications often terminates in chronic pockets, sinuses and fistulae in the ischio-rectal fossa, rectum, bladder and perineum. Semen is an element in the fistula no matter where it empties and should therefore always be looked for in suspected cases, associated with urinary or fecal connections. Rupture of the abscess into the peritoneum and septicemia have been noted in fatal cases. Myositis, tenosynovitis and arthritis and other signs of absorption may also occur, and do occur rather more frequently with seminal vesiculitis than with any other gonococcal manifestation. Ureteral pain, owing to the relations between the ureter and the ampulla of the vas and the vesicle on each side of it and arising

<sup>1</sup> Loc. cit.

om nervous irritation. The sexual symptoms are frequent erections and seminal emissions, accompanied by blood and the colic just spoken of, which is a more common cause of the colic than drainage of the pus.

The local objective symptoms of acute spermatocystitis without retention had best be obtained on a full bladder. Definite knowledge of the anatomical position of the parts is necessary. Above the prostate, near the angle of each lateral lobe, lie the common ejaculatory ducts formed by the confluence of the vas deferens with its ampulla nearest the middle line with the duct of the seminal vesicle, most laterally close to the pelvic wall. In the angle between the ampulla and the seminal vesicle is the ureter, usually out of reach in health unless the examining finger is unusually long and the bladder highly distended. From without inward the structures are therefore high up, the seminal vesicle, ureter and ampulla and low down the duct of the vesicle and the outlet of the ampulla uniting into the common ejaculatory duct. In order to reach the vesicle the finger should be passed to the angle of the prostate and then as far upward and outward to the pelvic wall as possible. This manipulation will never fail.

One or both vesicles and invariably the one more than the other will be found hot and tender, tense and elastic or fluctuating. Even gentle touch often causes sudden flow of the contents into the urethra, which the patient announces. Urinalysis shows all glasses filled with pus. The author's seven-glass test is important. The first three glasses from a full bladder are accepted as reasonably indicative of the urethral contents; gentle massage of the vesicles will be followed by great increase in the pus of the sixth and seventh glasses, containing rather clearly the separated pus of each seminal vesicle. The fifth glass contains the prostatic secretion. A catheter carefully passed eliminates the bladder in the fourth glass. Thus most pus will be in the first and second urethral glasses and in the sixth and seventh or seminal vesicle glasses and least pus in the third glass in the average case, unless the prostate is greatly compromised.

Phosphaturia from the constant leakage of semen into the urethra is sometimes seen, especially in the first glass and massage seminal vesicle glasses, thus distinguishing it as a local and not a renal phosphaturia.

These facts should make a diagnosis, but the exploratory needle may be used—not advisedly, except in very skilled hands. The routes are two: through the rectum, which is to be condemned on account of the danger of infection and fistula and through the perineum, which is the safer, under the following technic: The skin may be nicked with a scalpel in the perineum about one inch (3 cm.) anterolaterally from the anus, and then with the finger in the rectum as a guide, the needle is entered and directed upward, outward and slightly forward, passing the prostate along the finger, which should be on the lower part of the vesicle. A specimen thus obtained should be microscopically examined.

The microscopic diagnosis displays pus, detritus, spermatozoa, gonococci and its allies, and should never be omitted. Its feature is paucity

of prostatic elements, provided the prostate is little or not affected and the vesicles predominately or solely involved.

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<sup>1</sup> Loc. cit.

in the pressure and obstruction of the distention and perivesicular infiltration, is often a later sequel in severe cases.

**Complications.**—The complications of acute seminal vesiculitis are rather the lesions with which it is commonly associated—namely, funiculitis, epididymitis, orchitis usually making one and the same clinical picture and prostatitis generally the condition to which it is secondary. Intense funiculitis may cause peritoneal symptoms along its course from the base of the bladder upward, forward and outward to the deep abdominal ring, and if it were not for the obvious local infection appendicitis might be suspected.

**Diagnosis.**—The two general forms of this lesion must be remembered and distinguished.

*Acute seminal vesiculitis without retention* implies a vicious antero-posterior infection of the urethra, in its history, with intense involvement of the posterior portion of the tube and often combined with prostatic and testicular lesions, even overshadowing symptoms from the seed sacs themselves. The local subjective symptoms are absent or merge with those of the other sexual glands, such as the prostate, or are otherwise sensory, urinary, sexual and rectal showing intense irritation. Objectively are found enlargement of one or both sacs and signs of infection with infiltration, swelling, pus formation and perivesicular invasion. Systemic symptoms are those of severe infection at any other point of the body. Although at first seminal vesiculitis seems to give less absorption than prostatitis, in the end it leads much more frequently to arthritis and similar remote complications. Irrigation of the urethra followed by massage of the vesicles, with careful avoidance of the prostate, develops characteristic contents for the laboratory. By repeating this test at different sittings a specimen from each sac may be obtained with reasonable distinction between the two. Microscopic features display pus, detritus, spermatozoa, gonococci and its allies. Its feature is paucity of prostatic elements, provided the prostate is not massaged in securing the specimen and is itself much less involved. Treatment of the urethritis, as in other complications, tends to benefit this, but the local measures of massage and similar procedures have a direct influence. Direct treatment of the vesicles should not be undertaken until the subacute stage has long been established.

*Acute seminal vesiculitis with retention* is a fully established abscess of the seed sac and offers all the intense forms and kinds of symptoms just described, but much increased. Rectal examination presents a tense or fluctuating mass and widespread perivesiculitis. If external rupture has occurred, exploration of the sinus with the probe along the rectal finger is advised and final in its proof. Surgical evacuation of the abscess, as yet unruptured or after rupture, will reach the cavity of the destroyed sac and dispel any doubt of the lesion.

**Differential Diagnosis.**—Differential diagnosis respects tuberculosis and neoplasm in the following general terms:

*Tuberculous differs from gonococcal spermatozystitis* in the history of other foci, as in the lungs, joints, kidneys or urine, in the symp-

toms of pus, less common, of blood more frequent in the early stages, and wasting manifest in the later stages; in more pain of nagging character and in the presence of nodes and nodules which are tender not only in the vesicle but in the prostate, ampulla of the vas, the vas in the groin and scrotum and epididymis on one or both sides, in its painful seminal emissions and in signs of tuberculosis in the bladder and posterior urethra on cystoscopy and urethroscopy. The laboratory discovers no gonococci on smear and culture but the bacillus of tuberculosis, verified by animal inoculation. There is no gonococcal complement fixation reaction, but often the tuberculin reaction. Pus in the specimen is often less prominent and blood more prominent. Treatment by the standard methods of management and support against tuberculosis are of avail. Serotherapy with tuberculin and other bacterins is often of advantage, while open invasion of the vesicles is undertaken with caution because the wound often becomes infected widely and sinuses which never heal may result.

*Neoplastic differs from gonococcal spermatoecystitis* in having a very dubious history of no infection with the gonococcus and no tuberculosis in the kidneys or elsewhere in the body; in its unilateral situation; in its early indefinite or absent symptoms of dragging and discomfort, of irregular bleeding with or without seminal emission or coitus, and of tendency to painful erections; in its nodes, at first discrete then with progressing infiltration, with little or no pus but more blood on pressure, and finally with involvement of the whole region. The author's seven-glass test will secure a specimen from the diseased vesicle in glass seven, from which the diagnosis may be possible, provided tumor cells appear in the exudate. The bloody character of the tubercle bacillus tends to show that the disease is not tuberculosis. Cystoscopy is negative early, but later the bladder is deformed by the prominence of the tumor and engorgement of the bloodvessels, and may ulcerate by direct contiguity. Urethroscopy in the invasion is negative, but blood may be discharged from the vesicle on pressure, with little pus at first, then much, associated with detritus from one side. The laboratory rules out the tubercle bacillus and the gonococcus, the tuberculin reaction and the gonococcal complement fixation test. Specimens contain pus, blood, detritus, epithelia and sometimes shreds of tissue establishing the diagnosis. Treatment if done early removes the affected vesicle and proves the diagnosis, anatomically considered; if done late the specimen taken does likewise.

*Calculus differs from gonococcal spermatoecystitis* in having little or no history or one similar to that of the complication without retention; in its symptoms of spermatic colic on the effort to evacuate the vesicle during orgasm, emission or massage, due to the temporary plugging of the duct or moving of the calculus about in its pocket in its pain milder but comparable to that of bladder calculus, situated in or referred to the testicle or penis, the rectum or perineum and the sacral or lumbar region; in its dull discomfort, instead of pain due to irritation by the stone and evoked by a full rectum or bladder and the

evacuation and by massage. Rectal examination detects the stone and secures a specimen of the pus. Urethroscopy is negative unless the duct is inflamed or pus presents in the field on pressure. The seven-glass test of the author will show one vesicle diseased and the other normal. The laboratory proves the absence of tubercle bacillus and the gonococcus, the tuberculin reaction and the gonococcal fixation test, but shows pus and blood cells, mucus and detritus from the affected organ. Treatment with hot sitz baths and rectal irrigations and medicinal sedatives relieve the symptoms as in any other form, while exposure of the vesicle and removal of the stone finishes the diagnosis.

**Chronic Seminal Vesiculitis.**—Chronic seminal vesiculitis repeats the story of severe and complicated attacks in the history of gonococcal urethritis or in that of a single intense attack without cure but with relapses of discharge. The actuality of or tendency to absorptive signs is almost essential.

In *chronic spermatozystitis without retention* insistent discomfort and consciousness of the perineal zone without real pain is the chief complaint, adding variable frequency of urination, much discharge of pus in clumps, slugs and strings and expression of semen and pus during defecation. Almost uncontrolled sexual excitement and seminal emissions mixed with pus and blood are not uncommon. Objectively, the vesicle on one or both sides shows enlargement with prominence, thickening with sclerosis or thickening with boggy and a free flow of pus and detritus—all by rectal examination. The seven-glass test reveals the anterior urethra without much involvement, the posterior urethra with many slugs and strings of pus, the bladder contents normal, the prostatic glass without or with elements from this gland and either or both seminal vesicular glasses equally or variously filled with the products of focal inflammation. The difference between these two glasses diagnosticates the more involved vesicle and whether or not the prostate is much involved as is frequently the case. Systemically there is less intense disturbance but more absorption than in acute lesions, so that arthritic, myositic, tenosynovial and cardiac lesions are by no means uncommon.

In *chronic spermatozystitis with retention* all the foregoing subjective and objective conditions are found with the fact of a true abscess in or about one or both vesicles added, which follows either the chronic persistent course with little or no change or the chronic progressive course with relapses. Absorption furnishes the greatest syndrome which may simulate almost any other disease, such as anemia, myelitis, neuritis and neurasthenia. Cautious analysis of each case is essential. Urethroscopy of the deep urethra in both types of the lesion reveals pus from the prostatic ducts if this gland is compromised, and pus from the seminal ducts which may have nearly normal or greatly inflamed mouths in a colliculus covered with edema and granulations. Much involvement of the posterior urethra is common. The finger in the rectum readily expresses pus for a specimen, which in the labora-

tory on smear and culture reveals the gonococcus, with its allies combined with spermatozoa and epithelia. The seven-glass test also furnishes desirable specimens and the gonococcal complement fixation test is the final positive point. Treatment by massage of the vesicles by their exposure in the open operation completes the diagnosis.

**Treatment.**—Gonococcal seminal vesiculitis has recently assumed great importance in all its aspects. Its significance is major because spermatocystitis is the most potent single factor in the absorption causing arthritis and similar systemic invasion.

Prophylaxis so far as possible avoids the causes enumerated in the clinical review on page 127, such as ill health, attacks of catarrhal and diathetic urethritis, frequent congestion in venereal and dietetic excesses or in traumatism of instrumentation and medication. Directions as to sexual abstinence from direct and indirect excitement or masturbation or intercourse during a chronic urethritis are important and emphatically so in judicious treatment of posterior acute or chronic urethritis. As the symptoms emerge imperceptibly from those of the posterior urethritis abortion is not practicable.

**Curative Treatment.**—Relief of infection of the sperm sacs must be guided by the features of each case. Thomas and Pancoast<sup>1</sup> say—“Thus the following considerations arise: (1) Is the ejaculatory duct strictured or obstructed? (2) is the vas deferens strictured? (3) is the inflammatory collection in the seminal vesicle loculated?” and quote Belfield<sup>2</sup> and Aschoff<sup>3</sup> to show that strictures do occur. Seminal vesiculitis with occlusion therefore forbids success to massage and vasopuncture or vasostomy and indicates vesiculotomy.

Subjective and objective symptoms are sensory, urinary, urethral, rectal and sexual in their elements, locally, as presented in the clinical data on page 130. They have the general type of irritation in the acute lesions and of the production of pus with discharge or of the production of pus with retention in the chronic cases according to the patency or occlusion of the duct. Systemically absorption is seen chiefly in the chronic form with relapses, due to temporary occlusion of the duct and retention of the pus, as relapsing abscess and less commonly when the duct is not obstructed and drainage is more or less incessant and indolent. Both forms, however, are often active foci of low-grade systemic involvement.

Management should tend to maintain resistance and bodily health and to provide antisepsis by suitable hygiene and other protection. Rest in bed is imperative during the acute disease or active exacerbations of the chronic disease and sexually through abstinence from intercourse and other excitement and the abolition of seminal emission by suitable sedatives. In chronic cases this reflex cannot be controlled except through avoidance of irritating food, drinks and the fondle

<sup>1</sup> Loc. cit.

<sup>2</sup> Jour. Am. Med. Assn., March 15, 1900, p. 800; November 22, 1913, p. 1867; Sur. Gynec. and Obst., May, 1913, p. 569; November, 1916.

<sup>3</sup> Loc. cit., p. 24.



of women, but intercourse must be forbidden—all on account of the hyperemia which in these subjects is bad. Exercise is abolished during active symptoms and is begun with walking in chronic cases and with avoidance of agitation and vibration incident to cycling, running, automobilism, railroad-riding and the like. Diet and drink are of the fever and nephritis types in acute cases, and always of light, non-irritating varieties in chronic lesions. Alcohol in any form or amount had best be abandoned.

In physical measures, overstimulation or even traumatism in acute cases forbids massage, but the failure of competent drainage and even retention of pus require it in chronic spermatoecystitis without or with occlusion of the duct. The preferred method requires a full bladder, insertion of the gloved and well-lubricated index finger into the rectum, supported by the hip for penetration (Fig. 22). The vesicle lies farthest out of the three structures, which from without inward and above the prostate are the seminal vesicle, ureter and ampulla of the vas. The finger reaches the highest part of the vesicle, and with steady, firm, gentle pressure passes along it from above downward and from without inward toward the urethra and prostate, where the ejaculatory ducts empty. The ampulla of the vas is felt for and massaged in the same way because it is almost always diseased likewise. Several minutes are given to the massage of each side and the treatment is repeated once in five to seven days or oftener if well borne, which implies no reaction in the testes, prostate or seminal vesicles themselves. Such massage duplicates the action of sexual intercourse in emptying the seed sacs of semen and of pus in this disease at regular intervals, but differs from coitus in its freedom from congestion and excitement.

The hydrotherapy, locally, requires all measures to be stopped in acute disease, to which rule irrigation of the bladder and retrojection of the urethra in cases of acute retention of urine are exceptions exactly as specified under prostatitis. Rectal irrigations through the double current tubes or through the prostatic cooler are fully worth while in the active cases, and sitting baths and leeches may be added as potent decongestants. General baths augment elimination and may inhibit absorption and benefit rheumatic tendency. Turkish baths are best of all. Light is a convenient exchange for the heat of hydrotherapy and for its known actinic and penetrating effects. It is attractive because so easily applied by the patient himself with the 60-candle power therapeutic lamp several times a day for from thirty to sixty minutes at each sitting.

The electrotherapy, locally, is contraindicated in acute cases, but is reserved for declining and chronic disease according to the case. Diagnosis of the exact lesion is all important. Persisting infection calls for the high-degree vacuum glass electrodes (Fig. 69), inserted into the rectum and applied to the affected vesicles in turn and steadied in a suitable holder against slipping. Urethral treatment is of less service. Attachment to the negative pole of the standard multiple-



plate high-speed static machine is made. The spark gap is from one-half to one and a half inches for intensity, five to ten minutes fix the duration and alternate days are the frequency. There must be no pain or reaction after these treatments and the intervals and the sittings are made longer as the case progresses. In absent infection the static wave current is applied through the metal electrodes, connected with the positive side of the same static machine. A spark gap from one inch to six inches sets the intensity within the tolerance of the patient, twenty minutes limit the duration and alternate days give the early and longer intervals the later frequency and the accepted interruptions should be readily counted. Electrolysis, by which a copper, zinc, aluminum or silver electrode insulated with shaft to protect the anterior urethra is passed into the deep urethra and attached to the positive galvanic pole, is of moderate value for the urethritis. The indifferent electrode is applied to the abdomen. The current is measured to from 3 to 5 milliampères and the duration five to ten minutes and the frequency every three to five days. There must be no reaction. Adhesion or spasm about the electrode requires reversing the polarity until the instrument is free before withdrawing.

The systemic electrotherapy duplicates that described under acute urethritis, and referred to under prostatitis, as of benefit to elimination through the skin and kidneys, nutrition through the digestion and circulation and sedation through the nervous system.

Medicinal measures in the acute spermatocystitis suggest sedation of circulation, sensation, reflex irritation and functional disturbance by systemic administration exactly as in urethritis itself. Support against absorption and depreciation of health with the secondary rheumatic tendencies is aimed at in the chronic forms. The various drugs and formulas available are the same as those given in previous pages for acute and chronic urethritis and for other complications in their acute and chronic manifestation.

The serumtherapy may aid but is without value in some patients. The serum in acute cases may establish passive immunity, while the bacterins either in the autogenous, heterogeneous or Van Cott's<sup>1</sup> mixed form will possibly induce active immunity, as described in section on this subject on page 520. Persevering administration without exciting extreme negative phase, and with the aid of other means of treatment, is important, but gonococcal laboratory products are not as successful as, for example, diphtheria antitoxin.

The local administration invariably presents no treatment of the urethritis until the vesiculitis is well along on its decline. As in hydrotherapy, irrigations, injections, instillations and applications are all stopped during the acute symptoms. Retrojections in the presence of acute retention may be allowed with dilute fluid. Retention of the catheter is preferable to frequent passing of it for this purpose. In the

<sup>1</sup> Loc. cit.

chronic stage, after the seminal vesicle has been dealt with surgically, all the methods and drugs applicable to posterior chronic urethritis may be chosen with caution, judgment and gentleness.

In nonoperative surgery of acute periods, only during retention of urine an indwelling catheter may be used for relief for a few days, with lavage of the bladder several times daily, or if not severe a small soft-rubber catheter may be passed and irrigation performed with retrojection. In the late aftertreatment, after the operation, the posterior urethritis requires attention, but its treatment must have no reaction but only progressive benefit, and should be discontinued at the slightest disturbance. Dilatation gently performed with the author's irrigating sound, with flushing of the bladder and retrojection, or in the same manner the Bangs instillating sound and the Kollmann dilators may be used. Gentle massage of the posterior urethra with a soft catheter or flexible dilator in place is sometimes helpful when the case is nearly well and still has indolent symptoms.

Operative surgery provides the same rules for urethroscopic applications and fulgurations after the operation on the vesicles themselves has ceased and the sac recovered. As in prostatitis, these measures are of avail only for the remaining posterior urethritis. They are with effect only on the surface and immediate underlying region. There are four approved operations available: vasopuncture, vasostomy, and the vesiculotomy of Fuller and of Squier, and one disapproved technic—aspiration of the vesicle through the perineum. Thomas and Pancoast<sup>1</sup> describe the first two procedures as follows:

*Vasopuncture and Vasostomy.*—Chronic spermatocystitis, with or without drainage, is the proper selection of case for benefit without the dangers of radical operation, according to Thomas and Pancoast.<sup>2</sup> The instruments and supplies are scalpel, scissors, forceps, hemostats, ligatures, small sharp and blunt retractors, needle holder, needles, sutures, drains and dressings, with a large suspensory bandage, also hypodermic syringe, with the following drugs of which Thomas<sup>3</sup> prefers collargol, 10 per cent. The other preparations are 20 per cent. protein silver, made in the Hare Chemical Laboratory of the University of Pennsylvania; argyrol, 10 per cent.; protargol, 0.5 to 1 per cent.; nitrate of silver, 1 to 2 per cent. Anesthesia is by local infiltration with cocaine, 1 in 500 watery solution, or its analogues, and the posture is supine, with the one landmark of the spine of the pubis and the cord passing outside and below it, which places the incision over the cord from one to one and a half inches long passing through skin and superficial fascia as the superficial field down to the pillars of the superficial abdominal ring, with the cord emerging as the deep field, whose layers are separated to reach the vas deferens usually behind and above the other structures. A rubber-covered clamp, after Crile's method, or a stitch is passed across the vas distally to prevent penetration of the drug into the epididymis and secondary chemical reac-

<sup>1</sup> Loc. cit.

<sup>2</sup> Loc. cit.

<sup>3</sup> Personal communication to the author, April 25, 1916.

tion. Vasopuncture is performed by exposing the vas in the inguinal canal, and then injecting through a fine needle passed into its canal various medications, and vasostomy consists in leaving the vas open for numerous repeated medications. During such applications in either of these procedures the distal portion passing to the testicle should be very gently closed with a rubber-guarded clamp after the method of Crile, which will not injure it if carefully performed. The difficulties of these procedures are traumatism to the vas by repeated use of the needle and irritation of the mucosa by even dilute solutions; certainly no concentrated medications could be considered. The condition of the duct for outlet of such fluid must also be known, otherwise traumatism of the vas and vesicle by distention would be assured. This detail is exactly like that of injury to the pelvis and kidney by overdistention of the ureter with fluid opaque to the x-rays. The suture material is the finest plain catgut introduced transversely diametrically across the vas at about the midpoint of the oblique path of the needle puncture. By making sure to pick up only the outermost coat of the vas there is little danger of harm to the lumen, although it will be temporarily compressed. This stitch seems to be the only effectual method of preventing backflow of the silver solution along the path of the puncture and backward into the epididymis.

In vasopuncture the needle of the syringe is gently passed into the lumen of the vas deferens and from 3 to 5 c.c. of the solution gently injected, and then the vas is dropped back into place and the Crile clamp removed and wound closed with standard suture, with or without a small rubber tissue drain, for twenty-four hours against oozing. Primary union without incident is the rule and great pain in the epididymis and vesicle is the exception. One efficient injection relieves if this method is adequate at all in a given case. In vasostomy the vas is either slit longitudinally or transversely divided and brought into the wound for repeated medication during from one to four weeks. The repair of such an opening into the vas is the problem of this technic.

*Aftertreatment.*—The immediate aftercare provides primary union without drainage except for twenty-four hours and standard nursing and diet and symptomatic medication for vasopuncture, while secondary union is the rule for vasostomy. Remote aftertreatment respects the occasional chemical vesiculitis and epididymitis along the lines already described for them. Comments include the absence of danger to the seminal apparatus. Cautions avoid inflammation of the mucosa lining it by the use of only 3 to 5 c.c. gently injected and the end-results are a symptomatic cure shown by relief of symptoms and signs, by the absence of inflammatory products in the urethra in the author's seven-glass test and perhaps by the presence or absence of spermatozoa. On the last point, Thomas, in a personal letter to the author, has no conclusions and likewise concerning histopathologic restoration. The author feels that the difficulties of the procedures are those of traumatism to the vas by repeated use of the needle and of irritation of the mucosa by even dilute solutions.

*Fuller's<sup>1</sup> Vesiculotomy.*—Much credit is due Fuller, of New York, for developing the surgical treatment of spermatoecystitis. Selection of case respects all subacute and chronic conditions especially those with systemic symptoms and sequels, such as rheumatism unrelieved by other means. The instruments are few and usually only scalpel, scissors, long-grooved director, needle-holder, needles, sutures, rubber-tube and cigarette drains and gauze packing. Artery clamps and retractors are rarely needed as the operation has minimal hemorrhage and retractors may be omitted because the wound gapes widely of itself. The preparation of the patient and the field are the standard used in all major work with special attention to an empty bowel and ladder and the anesthesia is by choice general although spinal might be possibly used for the posture, which is the knee-chest supported by attendants or the strap and bar holders of the ordinary table. Super-

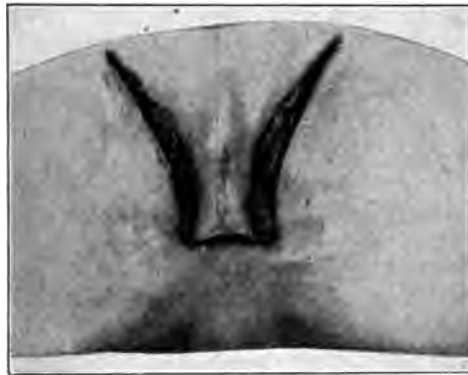


FIG. 26.—Line of incision. (Fuller.)

ficial landmarks are the tuberosities of the ischia, the borders of the sacrum, the anus and the perineal body while the deep landmarks as encountered are the central perineal tendon, rectum, ischio-rectal fossa, urethra and posterior surface of the prostate.

The incision is transverse from tuberosity to tuberosity well below the anus and joined at each end by a 6-inch lateral, oblique, liberating division along the borders of the sacrum. All three cuts interest the skin, superficial fat and fascia exposing the superficial field, as Step I, Fig. 26. Perineal dissection is Step II. Natural retraction of the wound releases the rectum for separation from the prostate preferably with the back and not with the edge of the knife in order to spare the muscles of the perineum and the vessels of the rectum which retract upward with the bowel while the perineal body with the prostate retracts downward, both through normal elasticity of the tissues. The central raphé and tendon of the perineum are divided as in Fig.

<sup>1</sup> Jour. Am. Med. Assn., May 4, 1901; Am. Jour. Derm., vol. x, No. 3; Med. Rec., January 23, 1915; Tr. Am. Urol. Assn., vol. vi, p. 274; Tr. Am. Urol. Assn., iii, p. 44.

27. The finger must be in the rectum as a guide for this technic. Rectal isolation is Step III involving its separation from the prostate, seminal vesicles and bladder in the deep fields. The left finger is in the rectum while the right works with the palm toward the prostate and the tip curved to avoid injury to the bowel, which should not be entered. Bands resisting the finger are cut through. When



FIG. 27.—Perineal dissection. (Fuller.)

the rectum is thus freed the dissection is extended laterally to reach the seminal vesicles (Fig. 28). Insertion of director is Step IV along the apex of the forefinger of one hand resting on the seminal vesicle, while the opposite hand passes the instrument and holds it in place while the guiding finger is withdrawn (Fig. 29). Incision of the vesicle is Step V. The knife, guided along the director to the sac



FIG. 28.—Separation from the rectal wall. (Fuller.)

and its belly pressed against it by the guide, makes an incision the entire length of the spermatocyst through the posterior wall at least and in severe cases through the anterior wall also. Additional relieving incisions are placed in the same way in infiltrated cases (Fig. 30). Packing with gauze, as Step VI, is done along the finger as a guide, side to side: that is, the right finger directs it to the right vesicle while

the left hand does the packing, and *vice versa* (Fig. 31). Tube drains and sutures are Step VII so that a small rubber tube is in apposition with the depth of each vesicle and posterior to the gauze drain emerging near the lateral angles of the wound across the perineum (Fig. 32).



FIG. 29.—Placing the grooved director. (Fuller.)

The liberating incisions are now closed with silkworm-gut sutures and the gauze and tube drains are secured with safety pins and the latter with adhesive plaster against slipping. A suitable T-bandage or diaper is placed over a standard dressing, which completes the operation (Fig. 33).



FIG. 30.—Passing the knife. (Fuller.)

**Aftertreatment.**—Immediate aftertreatment evacuates the bladder and if spasm occurs use an indwelling catheter for a day or two with suitable lavage and the remote aftercare leaves the drains *in situ* for several days as long as they remain clean and changes the

dressings as often as discharge soils them. Irrigation of the wound is usually not necessary. Standard nursing and diet and symptomatic

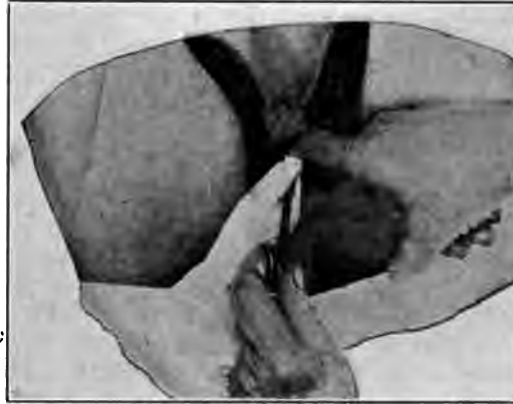


FIG. 31.—Placing the packing. (Fuller.)



FIG. 32.—Drainage tube and packing. (Fuller.)



FIG. 33.—The completed operation. (Fuller.)

treatment suffice. Attention to the urethritis is entirely abandoned until the patient recovers from the operation and then a thorough diagnosis and conservative treatment should be followed.



*Squier's<sup>1</sup> Vesiculotomy.*—This technic is an advance on Fuller's, in permitting the work to be done under the eye. The type of case is the one having predominant purulence, relapsing epididymitis, chronic



FIG. 34.—Perineal skin incision. (Squier.)



FIG. 35.—Skin flap retracted, showing fossæ on either sides of median perineal tendon which have been opened by blunt dissection. (Squier.)

<sup>1</sup> Cleveland Med. Jour., December, 1913. Boston Med. and Surg. Jour., June 11, 1914; New York Med. Jour., February 20, 1915.



persistent or chronic relapsing spermatoecystitis, pain and rheumatism. The preparation of the patient and the field, the choice of anesthesia and the recognition of superficial and deep landmarks are the same as in any other perineal operation and the posture is by choice the exaggerated lithotomy. The incision is the inverted U extending from tuberosity to tuberosity of the ischium. Retraction of the convex flap downward exposes the superficial field containing the central tendon of the perineum and the ischial fossæ on each side, marking Step I, Fig. 34. Opening the fossæ bluntly with scissors or clamp comprises Step II, shown in Fig. 35; while digital dissection into them after division of the central tendon but before division of the tendinous union between prostate and rectum is Step III, Fig. 36,

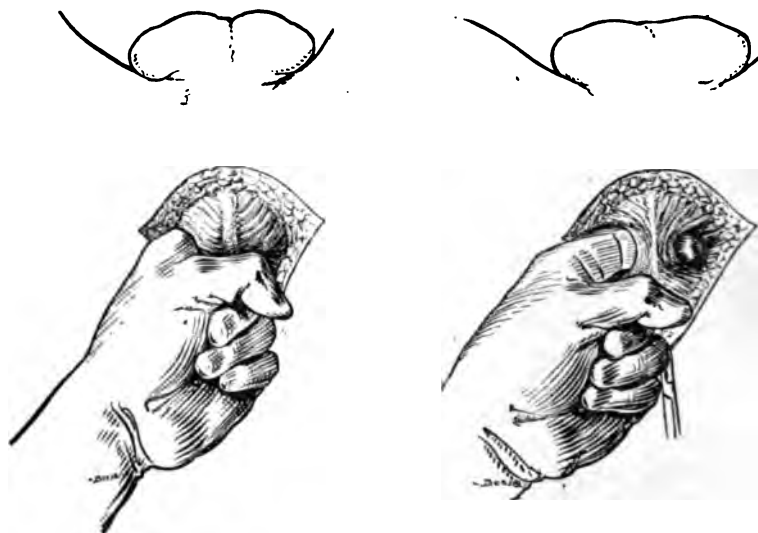


FIG. 36.—Median tendon divided, further blunt dissection of lateral fossæ. (Squier.)

FIG. 37.—Hooking finger around upper limit of muscular attachments between urethra and rectum. (Squier.)

and further penetration reaches the deep field of the operation. Isolation of urethrorectal muscles with the finger hooked around them and by division upon the finger along the tendinous part avoids injury of the urethra, spares the rectum and reaches the apex of the prostate in Step IV, Fig. 37. Isolation of rectum from the prostate, seminal vesicles and bladder in front and their retraction with a strip of half hard metal  $1\frac{1}{2}$  inches wide that may be bent as desired at any length for the depth of any wound in various patients is Step V, Fig. 38, and involves recognition of the vesicles by touch and sight. Prostatic traction by sutures passed near the bladder in either angle and by pulling toward the operator and upward toward the scrotum (Fig. 39) reaches the fascia of Desnonvillier bulged by the distended vesicles or matted with infiltration as Step VI, in Fig. 40. Vesicular

enucleation by dissection of the fascia from the sacs, much as the peritoneum is freed from the bowel, partially by blunt dissection and partially by snipping until the layer of cleavage is found, and all adhesions and inflammatory compression relieved, makes Step VII,

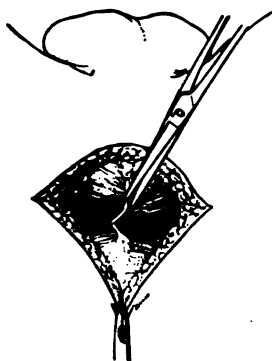


FIG. 38.—Proper line of division of urethrectal attachment close to the urethra. (Squier.)

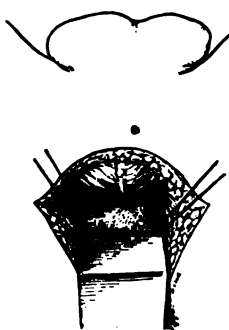


FIG. 39.—Traction sutures applied, at junction of base of prostate and bladder; posterior retractor in place. (Squier.)

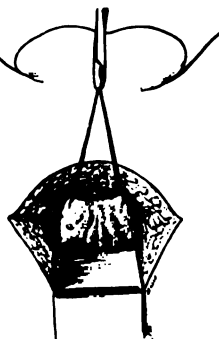


FIG. 40.—Traction upon sutures exposing vesicles covered by fascia of Desnonvillier. (Squier.)

Fig. 41. Drainage is now performed by free, single or multiple incisions of the vesicle, ampulla of the vas and any diverticula and a small rubber tube is sutured into appropriate pockets completing Step VIII, Figs. 42 and 43. Closure is performed by suturing the



FIG. 41.—Method of division of Desnonvillier fascia so as not to enter the vesicles. (Squier.)

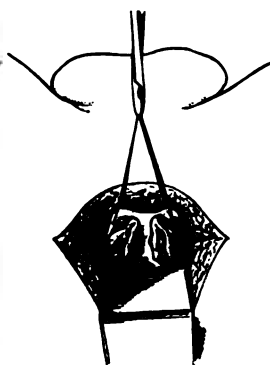


FIG. 42.—Wide excision of covering of fascia exposes vesicles beneath lines of incisions and punctures into vesicles. (Squier.)



FIG. 43.—Methods of anchoring the drainage tubes. (Squier.)

rectum to the urethra to restore as nearly as possible their former relations and then the skin is united in the standard manner leaving the drainage tubes at each angle (Fig. 44). A standard dressing

with a T-binder or diaper is applied, making the final Step IX. The cautions require as little cutting and as little traumatism as possible in the region of the deep perineal muscles, vessels and nerves. The terminal branches of the pubic nerves occupy the anterior portion of the perineal triangle and their injury would lessen or abolish erection. In general they are in relation with and run toward the crura of the penis.

*Aftertreatment.*—The aftertreatment is the same as that for any other perineal operation both immediately and remotely and duplicates that specified for Fuller's vesiculotomy.

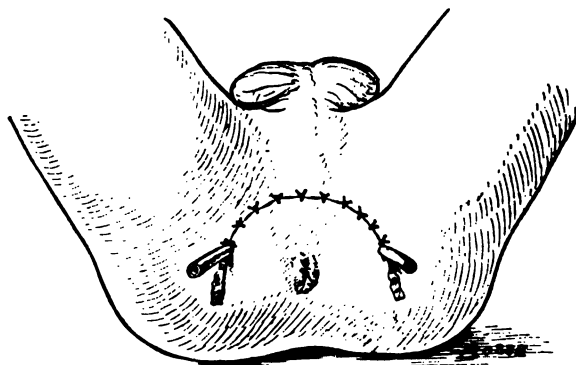


FIG. 44.—Closure of wound, showing position of tubes and gauze drains. (Squier.)

*Cure* in the pathological sense of restoring the seminal vesicles to their former anatomical and physiological state is well-nigh impossible except in the mildest cases, but the symptomatic relief followed by virtual physiological health is very often seen. Bacteriological cure is in large measure the most important because the vesicles may remain for many years a source of infection in intercourse and of absorption within the individual so that failure in this regard has a sociologic standpoint of great importance.

*Vesiculectomy* is still *sub judice* much as were the various tubal and ovarian operations about a generation ago when laparotomy was still a new technic. The chief reason of doubt is that it is very apt to be followed by sterility on the side affected because although the testicle remains, semen no longer reaches the urethra through damage of the outlet and surrounding tissues. In typical cases, however, the vesicle may be removed with little or no damage to the ampulla and the vas, provided there is not much perivesiculitis.

#### **EPIDIDYMITIS, EPIDIDYMOÖRCHITIS AND FUNICULITIS.**

**Clinical Importance.**—Infection of the testis and its duct, that is, the epididymis and the vas deferens, is a complication of gonococcal disease of grave clinical importance, because it may unsex the patient in either or both sides. In occurrence it is one of the two most com-

mon complications; the first is infection of the small urethral mucous glands and the second is invasion of the vas, epididymis and testicle. The laity denominate it "swollen testicle," or "big ball," independently of the varieties medically distinguished.

**Classifications.**—Varieties are recognized according to cause, occurrence, location and course. According to cause, the lesion is gonococcal or nongonococcal, of which the latter is rare and the former almost universal and, therefore, accepted as the type for description and comparison. As to occurrence the infection is primary or secondary, of which the latter is almost the unvaried rule, in that it is a sequel of posterior acute or chronic urethritis, prostatitis, seminal vesiculitis and the like and in that it rarely if ever is itself antecedent to urethral or periurethral conditions, excepting alone tuberculosis, which does not concern this work. As to location, it is unilateral or bilateral and involves: (1) the epididymis alone, which is the commonest form, either as a whole or in the globus major or globus minor predominately; or (2) involves the epididymis and the testicle, which is the less common form, as a rule the orchitis being later than the epididymitis and the reverse order is hardly ever seen; or (3) involves the vas deferens as a whole or in portions, especially near the testicle and base of the bladder in the ampulla. Associated conditions which add subvarieties are vaginalitis or acute hydrocele and seminal vesiculitis. Extension into the tunica vaginalis from an epididymitis is in mild or marked degree rather common, but extension of an orchitis into a periorchitis is never seen as the process is limited by the fibrous tunica albuginea. Taylor<sup>1</sup> says that the more common variety is epididymitis with adjacent deferentitis and vaginalitis and the less common is epididymoörchitis with vaginalitis. A peculiar variety makes the epididymitis antecedent to the symptoms of urethritis and is explained by a latent focus of virulent infection in the posterior urethra, excited by alcoholic or sexual debauch and rapidly extending down the vas into the epididymis and testicle and inhibiting through its activity the onset of urethral symptoms exactly as it checks them temporarily when the reverse order of pathogenesis is seen. In each case it is to be noted that the urethral symptoms appear or reappear when the subsidence of the epididymitis is present.

**Etiology.**—As usual the causes are systemic and local, predisposing and exciting.

The systemic causes are chiefly predisposing, hardly ever exciting and are identical with the factors underlying all forms of urethritis, as previously stated on page 19. Low resistance to infectious diseases in general is undoubtedly the preëminent systemic cause.

The local predisposing causes respect really the antecedent conditions, particularly posterior acute urethritis, prostatitis and seminal vesiculitis. For discussion in the Chapter on the Complications of Chronic Urethritis, page 150, is reserved acute epididymitis arising

<sup>1</sup> *Genito-urinary and Venereal Diseases*, 3d ed., p. 114.

during an exacerbation of posterior chronic urethritis, chronic prostatitis and chronic seminal vesiculitis. In these, years after apparent recovery, local injury of the testicle by blows and falls, muscular strain or pressure, may cause an acute involvement of the testis. Likewise by the same factors an old epididymitis apparently recovered may light up in a fresh attack.

The local exciting factors are transmission of the organisms and lowered local resistance. The organisms are most commonly the gonococcus alone and much less frequently with pyogenic and other normally harmless bacteria of the urethra which descend the vas with great rapidity. Local resistance is diminished by excesses of diet, alcohol, intercourse and muscular action, especially such as shallows the organs: cycling, automobiling, horseback-riding, railroad running and the like. Resistance is also affected by traumatism—strains, falls, blows and the congestion of travel, by irritation of faulty instrumentation, injection, irrigation and instillation and of drugs internally administered, such as the balsams, or locally applied, such as the astringents. Cases are seen without assignable local exciting factor. One under the writer's observation had prostatitis and bilateral seminal vesiculitis, funiculitis and epididymo-orchitis with three weeks of his infection without treatment locally or systemically and without other assignable excitant. The resistance of this patient to the disease must have been practically *nil*.

The local predisposing and exciting causes of nongonococcal acute epididymitis are as follows: The urethra is normally inhabited by many nonvirulent organisms, which are harmless when quiescent in health, but harmful when carried into posterior urethra and inoculated into the raw mucous membrane by improper instrumentation at treatment and when engrafted on a catarrhal urethritis of any origin whatever. They may then invade the epididymis, as after stricturotomy operations, such as dilatation, divulsion, internal and external urethrotomy and prostatic operations such as suprapubic and perineal prostatectomy and prostaticotomy and even occasionally prostatic massage.

**Pathology.**—The manifestations are the same in primary cases as in secondary cases, so far as the affected organ is, strictly speaking, concerned. The essence of the process is invasion of the vas, epididymis and testicle usually by the gonococcus and much less frequently by other organisms. The epididymis is invaded as a whole or chiefly the globus minor, where it is a single tube or, in globus major, where it is many tubes, and the testis is involved in the seminiferous tubules and the vas throughout the whole or various portions of its length notably in the ampulla near the seminal vesicle and in its origin near the globus minor. As in every mucosa elsewhere the lesions are edema and infiltration, exfoliation and destruction of epithelia and proliferation. Even the fibrous framework of the testis, epididymis and vas may be involved. The exudate is the contents, consisting of semidetritus, pus and organisms, chiefly gonococci. Rapid progress

probably due to the confinement of the pus by the anatomical arrangement, so that the symptoms are so intense that one cannot distinguish the orchitis from the epididymitis; but on the other hand resolution of the exudate is the rule and abscess-formation the exception.

The temporary lesions predominate and are characterized by the foregoing description, but permanent lesions are by no means uncommon. They are infiltration, thickening and occlusion of the epididymis, especially in the globus minor, where the single tube of the vas is already established and less commonly in the globus major where the seminiferous tubules drain the testicle but are not yet confluent into one channel. Similar results may occur anywhere in the vas itself. Relative sterility as a common occurrence with even atrophy of the testis as a rare sequel occurs especially when the globus minor and vas are occluded, but the multiple tubes of the globus major make this result less common therein as some of these tubules escape relatively or entirely. The associated lesions are products of the epididymitis itself, chiefly acute hydrocele with the usual features of exudative inflammation, or are parts of the same general infection, particularly seminal vesiculitis, prostatitis and posterior urethritis, each discussed under its own subject.

Seminal vesiculitis occurs in at least two-thirds or three-fourths of the cases, either as the antecedent or as the associate of the epididymitis. Broennum<sup>1</sup> secured gonococci from the vesicles in 80 per cent. of his cases examined. Monod and Terrillon<sup>2</sup> sum up the pathology as follows: During the acute complication the seminiferous tubules become greatly swollen, their walls edematous and infiltrated and their epithelium loses its cilia. The tubules may contain pus and semen mixed and the connective tissue stroma in which they lie becomes edematous and infiltrated. Abscess is a rare formation because the exudate gradually resolves and is absorbed. Adjacent parts often involve the process and the testis is not frequently included. Acute hydrocele through inflammation of the tunica vaginalis is usual, as emphasized by Jacobson<sup>3</sup> and Malassez and Terrillon<sup>4</sup> found that an injection of 1 per cent. to 1.2 per cent. solution nitrate of silver in the deferens will almost always set up deferentitis and epididymitis. The solution is thrown into the inguinal canal with a syringe as near as possible to the deferens.

**Symptoms.**—The clinical characters of epididymitis are described in the stages of invasion, establishment and termination and in subjective and objective, local and systemic manifestations.

The stage of incubation and invasion is so merged with the antecedents, usually posterior urethritis, as to be masked by their symptoms. The onset is in primary cases between the third and sixth week of posterior acute urethritis with the fourth week as the average in uni-

<sup>1</sup> Hospital-tidende, 1907, No. 46.

<sup>2</sup> *Traité des maladies du testicle et de ses annexes*, Paris, 1889.

<sup>3</sup> *The Diseases of the Male Organs of Regeneration*, 1893, p. 255.

<sup>4</sup> *Arch. de physiol. norm. et pathol.*, 1880, vii, 738.

lateral cases. In bilateral cases, the second testis following the first by about three weeks or very rarely may accompany it. Secondary cases may appear at any time in the ordinary courses or during an exacerbation of posterior chronic urethritis, prostatitis or seminal vesiculitis. The symptoms of invasion are usually most rapid and tend to merge at once with the establishment, so that it is difficult to set the periods apart and to distinguish the involvement of the testis from that of the epididymis. The local subjective symptoms are usually prompt within twenty-four hours, but sometimes slower within two or three days of discomfort and incapacity for ambulation of the patient. There are present, neuralgia, pain and tenderness, weight, heat and discomfort. The local objective signs are slight enlargement, boggi-ness and tenderness. Systemic symptoms are absent or trifling unless produced by the antecedent conditions.

The local subjective symptoms of establishment are pain and sensitiveness, enlargement and weight, pollakiuria, heat, congestion and edema in the scrotum. Of these the last three are more distinctly physical signs. The pain and sensitiveness advance from dulness to sharp intensity, located at first in the vas and descending with the process into the epididymis and testicle. It may therefore first be noted deep in the pelvis in its intraabdominal portion at the base in the bladder and seminal vesicle or in the extraabdominal portion along the inguinal canal. It may be referred to the renal zone, perhaps through pressure on the ureter by the inflamed ampulla and seminal vesicle or through reflex influence. It is usually constant without remissions or with paroxysms at night, and sometimes accompanied by scalding bloody seminal emissions and always by hypersensitiveness, which is the prominent symptom. The pain and tenderness are increased by mction and decreased by rest and when the testicle follows the epididymis and the vas as a whole is involved, they are likewise greatly increased. Symptoms of local peritonitis aroused from the intraabdominal portion of the vas add their characteristic symptoms and increase those of the epididymitis. The early sense of weight is quickly followed by enlargement at first of the epididymis, then of the testicle, rendering support grateful to alleviate pain along the cord from the dragging. Pollaki-uria is often distinct from the conditions antecedent and from the secondary congestion on the floor of the bladder and about the ureter. Discharge regularly decreases, sometimes disappears, so far as the patient's observation is concerned.

The systemic subjective symptoms of the establishment are not marked, as a rule, excepting in severe cases or in virtue of the whole process of infection, in which the epididymitis shares. They are, as a rule, chill or chilliness, fever from 100° to 103° F., hot skin, coated tongue, thirst, anorexia, nausea, vomiting and constipation, depression, irritability, nervousness, headache and insomnia.

The local objective symptoms of establishment are tenderness, enlargement, heat, congestion and edema, hydrocele and discharge. Palpation shows extreme tenderness along the vas in its ampulla



through the rectum, along its course through the inguinal canal and down the scrotum to the globus minor, also in the epididymis as a whole or its tail or head in particular and finally in the testicle. If the latter organ has escaped, it is relatively not tender. As a rule, the acme of the tenderness is either in the globus minor or major of the epididymis. The enlargement may be moderate or great, tense, hard and tender, involving the epididymis only chiefly in its head, tail or body, or the epididymis with the testicle and the vas near its origin. The largest swelling occurs when all three are affected and hydrocele is added. The surface of the enlargement is smooth and tortuous and not hard, angular and knotty as in tuberculosis of these parts. When the epididymis as a whole is involved, it forms a large swelling above, behind and below the testicle, respectively, through the enlargement of its globus major, body and globus minor, so that frequently the sulcus normally between the two is obliterated. When the testicle is involved, one mass of fist size occurs, while the epididymis alone is like a large thumb lying upon the gland.

The heat, redness and edema of the scrotum are rather moderate if the epididymis alone is attacked, but somewhat more apparent when the testis, vas and tunica vaginalis are involved. Extreme cases show dull redness and lividity. Acute hydrocele or vaginalitis marks involvement of the tunica vaginalis testis in the process. The effusion may be fluid, moderate in quantity and difficult to recognize, or the reverse with very great swelling, or fibrous and scanty with adhesions. Marked cases of hydrocele usually appear with every symptom greatly increased: the pain is unendurable and referred to the thighs, perineum, spermatic cord, deep pelvis and even loins. The redness and edema are extensive and the subjective signs of infection unmistakable. The entire process may be regarded as at its height at this time. Frank discharge from the urethra is greatly diminished and practically abolished during the height of the process, but there is always sufficient exudate in the canal to permit smears and to show in the urinary test-glasses.

The systemic objective symptoms serve only to verify those complained of by the patient. The blood count corresponds with that of pus-processes. The urethral discharge is regularly scanty.

The stage of termination begins in five or ten days in cases without successful treatment, but in half this time in well-managed cases and persists from ten to fourteen days in the average case, less in milder, longer in severer examples. The subsidence of symptoms is rather rapid and more or less in the following order: Pain, tenderness, congestion and edema, hydrocele with its adhesions and the enlargement. The local and systemic subjective signs are very early in changing, the pain rapidly lessens, the fever falls, nervousness and indigestion disappear and the urinary disturbances decrease. The local and systemic objective symptoms behave in much the same way. The discharge previously diminished slowly returns, but is usually changed in consistency and quantity, being slightly thinner and more copious, as a



rule, owing to the improvement in the antecedent urethral condition progressing during the subsidence of the epididymitis.

Palpation is no longer the source of agony. The congestion, heat and edema of the scrotum vanish and signs of absorption of the hydrocele occur. Enlargement diminishes, so that the epididymis is distinct from the testis beyond the now normal furrow. Return of the testis itself to its normal state under the finger is earliest and most prompt if there are no sequels. Rapid involution of the epididymis is rare but in the average case requires weeks, sometimes months. Permanent enlargement as a whole or in the head or tail is frequently seen; as previously stated, chiefly in the globus minor where the seminiferous tubules have already become one duct as the origin of the vas deferens which for its first few centimeters may also suffer.

**Chronic Epididymitis.**—Relapsing, subacute and chronic infection of epididymis and vas are common, lasting for years. Sterility is the result of obstruction from the nodes and of destruction by the chronic suppuration. Destruction and atrophy of the testicle either from suppuration or disuse through strictured vas are by no means unknown. Acute epididymitis tends toward resolution if it has no sequels, but with sequels the outcome is different. The usual important results are the lesions of the vas and epididymis, already spoken of, damage to the testicle as a secreting organ, and the unusual sequels are abscess, cysts and atrophy of it, chronic hydrocele, gangrene of the scrotum, neuritis, neuralgia and finally septicemia and death.

Relapsing acute epididymitis during the subacute or subsiding stage is another form of termination. Its frequent attacks upon the delicate lining of the parts render it likely to cause abscess of the testicle or epididymis.

The outcome of gonococcal acute epididymitis relates to life and the organs involved. As to life, the result is good, as fatalities rarely occur. Septicemia is rare and is probably more the outcome of the general infection present than of the epididymitis itself. As to the organs involved, the outlook depends on management and treatment of the cause and of the lesion, on coöperation by the patient and on the tendency toward relapses. Without removal of the cause and proper care of the epididymis and testicle progress of the disease in the present and relapses in the future are invited. Without intelligent coöperation and a normal resistance to disease on the part of the patient, the end result is far less favorable. In the testicle absolute pathologic restoration probably never occurs in that certain tubules must remain permanently damaged from the nature of the infection, but such damage may be so slight as not to interfere with its function and hence cases of clinical restoration are the rule. In the epididymis absolute recovery seems likewise very rare, owing to the penetration of the disease into the fibrous wall of the canal, whence proceed thickenings which always remain but clinical recovery, however, is common. Only infiltration with occlusion are important. As previously stated, foci of disease in the globus major are less occluding than in the globus minor. Sterility

ility by occlusion may affect one testicle only without limiting impregnating power in the other gland, but sterility on both sides renders the victim childless but does not affect sexual desire or gratification. In domestic relations, therefore, a childless marriage may arise from these facts, which must be settled before the wife is held responsible and perhaps subjected to operative treatment.

**Diagnosis.**—After a urethritis of rapidly extending anteroposterior type, great severity and usually other complications, such as prostatitis, seminal vesiculitis and then extension into the groin as a funiculitis, in its history, the invasion of the testis begins. The element of funiculitis is invariably present. Direct and indirect trauma, exertion or excesses may be admitted. Symptoms are pain, tenderness, enlargement, weight, congestion, edema, all due to the testicular and other complications, pollakiuria proceeding from the posterior urethritis and urethrocystitis, temporary cessation of the urethral discharge from transfer of the active process to another organ and finally chill, fever and similar signs of septic absorption. Physical examination reveals tenderness, enlargement, heat, congestion, edema, hydrocele and discharge as the final index of the cause. Laboratory work is devoted to smear and culture of the urethral discharge for the gonococcus, which while decreased is still frank in amount. Treatment of the urethritis indirectly benefits the testicular condition and when the recovery period is present and urethroscopy of the posterior urethra safe, conditions there leading to the epididymitis may easily be recognized.

**Differential Diagnosis of Gonococcal Acute Epididymitis.**—Under this subject are considered undescended and anomalous testis, erysipelas of the scrotum, traumatic orchitis, traumatic hydrocele, tuberculous epididymitis, syphilitic epididymitis, neoplastic epididymitis and hernia.

*Acute epididymitis in undescended and anomalous testis* is often difficult to settle. The gland must be accessible in the inguinal canal or the superficial ring in nondescent. The epididymis may be attached above, before or below the testicle through anatomical defect, torsion of the cord or adhesions within the tunica vaginalis. All may be determined by the careful finger. The history will show an old or recent urethral infection and an acute painful course and the laboratory by smear or culture isolate the gonococcus. Rest in bed with its prompt results is an aid.

*Erysipelas of the scrotum differs from gonococcal acute epididymitis* in its severe general involvement, rapid advance over the scrotum, fiery redness, marginate brawny infiltration, absence of testicular symptoms and signs of urethral discharge, bacteriology and complement fixation test.

*Traumatic orchitis and traumatic hydrocele differ from gonococcal acute epididymitis* in the history of definite injury, very sudden onset, absence of funiculitis and of urethral findings and blood test. The light test is negative, but tension or fluctuation suggests fluid and

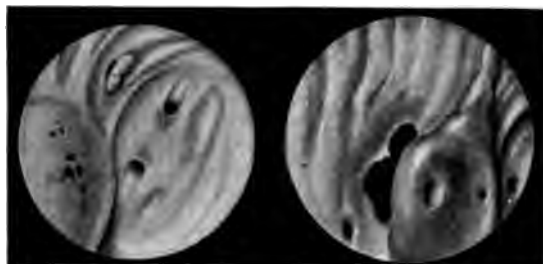


**FIG. 45.**—Hydrocele of the cord. The sac was nonadherent and was readily removed whole. (Author's case.)



**FIG. 46.**—Acute tuberculous epididymo-orchitis. Extensive involvement of the epididymis and testis is shown. (Author's case.)

tion brings blood. If the traumatic hydrocele is not a true hydrocele then the light test is positive and the needle evacuates the fluid of true hydrocele.



A

B

7.—Tuberculosis of the deep urethra. A is the deep urethra of a recent acute tuberculous epididymitis in a young man; from one of three dilated prostatic ducts pus exudes; B is advanced tuberculous prostatic disease in a patient having tuberculosis of the right kidney and its ureter. (McCarthy.<sup>1</sup>)

*tuberculous differs from gonococcal acute epididymitis* in being a chronic process. The history reveals tuberculosis elsewhere in the body. In many cases, insidious onset, little pain or systemic subjective symptoms, excepting those of the antecedent foci elsewhere. Somehow the emaciation, rapid pulse, anemia and afternoon temperature rise suggest all tuberculosis. Examination shows a knotty, nodular, fre-



A

B

48.—Tuberculosis of the deep urethra. A represents extensive lesions of the deep urethra in a case of tuberculous epididymitis, on account of which operation was used and climatic treatment adopted with marked benefit; B, advanced tuberculous foci of the deep urethra in a patient with nocturnal and diurnal frequency of micturition and occluded left ureter due to tuberculosis of the kidney. Focal necrosis with destruction of the prostate on the left and greatly dilated prostatic ducts on the right of the colliculus. (McCarthy.<sup>2</sup>)

ly adherent epididymis and foci in the seminal vesicles, prostate, vas deferens, and the like. Bacteriology of the urethral discharge is negative for gonococci, but if a sinus exists in the testicle, it may be positive

for tubercle bacilli. The gonococcal complement test is negative. Tubercle bacilli may be found in the urine in the mixed specimen of the bladder or in separated specimens after ureteral catheterization. The tuberculin test and tuberculous management are aids.

*Syphilitic* differs from *gonococcal acute epididymitis* also in being chronic. The history of syphilis in primary and secondary manifestations may be given, as the orchitis is usually tertiary. Physical examination elicits the testis as first and most and the epididymis second and least involved. Other lesions of the tertiary or secondary stage, as the case may be, are also usually present. The swelling is uniform without tenderness, adhesions or hydrocele. Laboratory investigation gives a positive complement fixation test for syphilis but negative for gonorrhea. Sometimes the *Treponema pallidum* may be obtained by aspiration of the testicle and anemia is usually present in neglected syphilis. There are no urethral pus, gonococci or other organisms except the normal urethral group. Marvelous results of intensive treatment with neosalvarsan, salvarsan, mercury and the iodides combined with hygienic management settle the question.



FIG. 49.—Teratoma testis, adult type. Patient well and without secondaries nearly three years after operation. (Author's case.)

*Neoplastic* differs from *gonococcal acute epididymitis* in its history of slow onset followed by perhaps regular rapid growth in a few weeks or months, absence of pain early, which appears, however, later. Anemia and emaciation and depreciation may be early and marked. Lymphatic involvement is early and characteristic. Teratoma of the testis is the most common and rapid form. Physical examination shows a stony, hard testis and in an advanced case the lymphatic channels and glands invaded. There is no special tenderness. The testis is usually attacked first, then the epididymis. The laboratory findings are no urethral pus, no gonococci or other organisms except the normal urethral flora, no complement fixation test for either gonorrhea or syphilis. The blood may show the changes characteristic of malignant disease.

*Hernia* differs from *gonococcal acute epididymitis* in its history of anatomical defect, or acquired and slow onset, after direct or muscular

violence or during chronic cough, constipation, strain and the like. The pain is of dragging not of intense incapacitating character and without fever, chill or other sign of infection. Physical examination reveals a mass in the inguinal canal or scrotum, insensitive, always somewhat distinguishable from the testicle and epididymis, with impulse on coughing and without redness or edema of the skin. Reducible hernia permits restoration of the mass into the abdomen; irreducible breech shows partial or absent return of the contents of the sac; inflamed or incarcerated hernia presents inflammation at the site of previously irreducible rupture, while strangulation adds the terrible elements of intestinal obstruction. Even in the last two, the diagnosis is easy and the mass separable from the testicle in no small number of cases.

**"Differential Diagnosis of Gonococcal Chronic Epididymitis."**—The same basis as in the acute exists—history, physical and laboratory examinations for distinction between chronic epididymitis and tuberculosis, syphilis and neoplasm of the testicle and hernia. The remarks given under the acute lesion concerning the diagnosis of undescended, anomalous and adherent testes need no repetition here.

*Tuberculous differs from chronic epididymitis* in the history of other tuberculous foci, slow onset, absence of urethritis and perhaps latent progress in the testicle, rather than early subsidence and later persistence from an acute process. The physical examination may reveal the other foci and the systemic depreciation. Nodulation, adhesion of the testicle to the skin, chronic hydrocele and local abscess and sinus may be present. Laboratory and bacteriologic examination reveals no gonococci in the urethral discharge and not infrequently tubercle bacilli in the urine and semen, for which the guinea-pig test must often be employed. The various tuberculin tests are also available with caution as to deductions.

*Syphilis and neoplasm of the testicle and hernia* are sufficiently distinguished from chronic epididymitis under its antecedent acute form, so that further review would be redundant.

**Treatment.**—Gonococcal epididymitis, epididymoöorchitis and funiculitis in their significance as complications damage the vas, epididymis and testes more or less profoundly or permanently and unilaterally or bilaterally so that relative sterility may result. The injury may be partial and what is sociologically important, infectiousness through the semen may persist for a long time.

**Prophylaxis.**—Careful instructions as to care are essential during posterior acute and chronic urethritis. There must be no excesses by the patient in diet, drink or sexuality. Thorough comprehension of lesions and adaptation of treatment are necessary on the part of the physician to prevent extension of the infection from the urethra to the sexual glands. The principle of immediate cessation of all local treatment, such as irrigation, at the earliest sign of tenderness or neuralgia of either testis is too little understood and followed. Special avoidance of the predisposing and exciting causes given in the clinical

section on page 147 is important. All attempts at aborting infection is incident. Further progress cannot be checked if going prevention has failed because the symptoms arise indubitably from those of the posterior urethritis.



FIG. 50.—Bellevue bridge for epididylmitis. The wide adhesive plaster depressor supports and gauze pad are shown in the upper half. The lower bridge ready to place appears in the lower half. (Author's model.)



FIG. 51.—Hayden's "bridge" for an acutely inflamed testicle. (Hayden.)

The reader is referred to pages 495 to 497 of Chapter IX of *Principles of Treatment* for data of management.

<sup>1</sup> Loc. cit.



*Curative Treatment.*—All measures at definite relief are referable to the features of each case. The physical measures are of little benefit until the severity of the attack is over and then their service is indirect. Massage of testis and epididymis is impossible but of associated prostatitis and seminal vesiculitis is in the *late* declining stage advisable in aiding the cessation of one source of the lesions in the testes and their outlets. The uniform pressure of a rubber bandage belongs under this heading. It is made of dentists' rubber dam cut in a strip about two and a half inches wide and eighteen inches long, with a short piece of adhesive plaster attached to the middle of one end. The bandage is wound reasonably tight about the affected testicle and secured by the adhesive plaster, which must be short enough not to interfere with elasticity in accommodation of possible increased swelling. Hydrotherapy is the ice-bag locally applied to the testis supported by the bridge and protected by gauze or flannel and to the affected inguinal canal for the funiculitis. Hot poultices of lobelia and tobacco are said to be soothing and sedative. Irrigation of the rectum for the prostatitis and seminal vesiculitis, associated, indirectly benefit the testicle, and in the later stages hot sitting baths decongest the entire region. Systemically, body baths and Turkish baths aid in elimination of absorptive conditions. The application of light during long periods several times a day by the patient with one of the approved therapeutic lamps soothes, decongests, resorbs and further acts in actinic influence, especially in the later neuralgic pains and vascular spasm. The electrotherapy is important even during the acute stage. In the declining and terminal stages, however, the following modalities are indicated: The modality<sup>1</sup> is the local application on the epididymis, testis and vas deferens of a surface vacuum electrode attached to the negative pole of the multiple-plate, high-speed, static electrical machine with the positive pole grounded. The intensity is a spark gap of a half-inch to one inch giving 0.5 to 1 milliampères of current which in duration must remove all pain at a given sitting—usually in from fifteen to thirty minutes or more. Frequency is daily for from seven to ten days, producing an action relieving vascular spasm and inducing resorption and drainage through the natural vascular and lymphatic channel and having a result, as a rule, of the disappearance of the enlargement in about ten days.

The medicinal measures are sedatives for the pain, urinary antiseptics for the pus and urinary diluents and antacids for the pollakiuria, circulatory sedatives for the hyperemia and supportives for the toxic influence, if present, and alteratives, such as the iodide of potash, for resorption—all by systemic administration according to indication. Of questionable value during acute stages is serotherapy, except in the occasional patient benefited by the antigonococcal serum for the establishment of passive immunity. In the chronic periods, however, a few

<sup>1</sup> Modality is a term used by electrotherapeutists to denote the type of current used.



patients are greatly restored by autogenous or heterogeneous bacterin, especially of the mixed type, such as Van Cott's, when absorption is present, chiefly from the associated prostatitis and seminal vesiculitis.

The local administration of any urethral treatment should be discontinued during the acute period but ointments, such as ichthyol, in 10 to 25 per cent. strength and guaiacol in 25 to 50 per cent. strength are of great service. Rectal irrigations with the double current tube or the prostatic cooler treat the periurethral structures with benefit to the testis. Only after the epididymitis is nearly well should any urethral treatment be even cautiously begun and most conservatively continued. Chronic epididymitis may be made acute and relapsing by improper invasion of the posterior urethra. Therefore, instillations, retrojections, catheter-and-syringe irrigations and applications in the order named and beginning with very mild fluids are the only posterior urethral treatments proper.

*Nonoperative Surgical Measures.*—If acute retention of urine is present, catheterization is called for and if repetition is necessary the indwelling catheter is preferred for a day or two with protective lavage of the bladder and decongesting hip-baths. The best dressing of the testis is the rubber bandage described above. Adhesive plaster strapping is also recommended with the disadvantage of inelastic resistance to possibly advancing enlargement. After the epididymitis is cured all the other nonoperative measures devoted to the posterior urethra become available, as just mentioned. If stricture is a basis of the lesion the author's irrigating sound is of special value in combining gentle dilatation with retrojection, but injections by the patient are hazardous even after the epididymitis has declined.

The *operative surgical measures* are five: (1) Epididymotomy for pus in acute stages; (2) Hagner's transplantation of the vas in chronic obstruction; (3) prostatotomy for pus as an associative lesion; (4) seminal vesiculotomy for pus as a concomitant focus; and (5) urethrotomy for stricture as an antecedent condition.

Of these five procedures prostatotomy is fully discussed under parenchymatous prostatitis (page 125), seminal vesiculotomy under spermatoecystitis (page 139), with occlusion and urethrotomy under stricture (page 395), and will therefore need no further note here.

*Epididymotomy (Hagner's<sup>1</sup> operation)* is available in acute epididymitis for evacuation of the pus when there is much accumulation and excessive swelling in selection of case. The operation is not difficult and requires as instruments and supplies scalpel, tenotome, scissors, forceps, hemostats, small sharp and blunt retractors, ligatures, needle-holder, needles, sutures, drains and dressings with large suspensory bandage. The preparation of the patient and field are standard and the anesthesia is by preference general on account of the sensitiveness of the testis during the manipulation but may be local by infiltration of the inguinal branch of the genitocrural nerve

<sup>1</sup> Tr. Am. Assn. of Genito-Urinary Surg., 1907, v, ii, p. 262. Ibid., p. 37. A m. Surg. May, 1908. Med. Rec., December 4, 1909. Ibid., August 10, 1907.

it emerges from the superficial abdominal ring. The posture is pine and the prominence of the swelling along the epididymis at the interval between it and the testis is the one landmark, determining the site, extent and depth of the incision, which passes through the skin and dartos as the superficial field down to the tunica vaginalis and after hemostasis reaches the obvious point of accumulation after free division of the tunica to the limits of the skin opening. The testis is then delivered upon warm towels and examined. Multiple punctures with the tenotome are made penetrating the infiltrated fibrous capsule and entering the thickened connective tissue beneath the deep field. As the knife pierces such thickenings marked decrease in resistance is felt and free pus may escape from any of the openings, which should be enlarged and gently probed toward the pocket, which is safer than further use of the knife, and then gently massaged until empty. Irrigation of each pocket in the epididymis and of the whole cavity of the tunica is then done with 1 in 1000 bichloride of mercury watery solution followed by normal salt solution. Light suture of the tunica with catgut after restoration of the testis to its bed and drainage with a cigarette packing through the suture line in the tunica down to the epididymis followed by standard closure of the skin with silk and a generous dressing within the large suspensory bandage or a T-binder closes the operation.

*Immediate Aftertreatment.*—Packings secure drainage and avoid adhesions as far as possible and remote aftercare is devoted to antecedent and associated conditions within and about the urethra. Drainage usually ceases on the fifth to the tenth day and the frequency of dressings is correspondingly decreased. Accepted diet and medication are, of course, the rule.

*Epididymovasostomy* (Martin's<sup>1</sup> operation).—The following essentials are noted in the careful selection of case for reasonable chance of success. Sterility due to causes other than obliteration of the tail of the epididymis is a contraindication and the patency of the vas deferens from the epididymis to the prostatic urethra must be demonstrated by preliminary injection of pigment passed in the urine or received in massaged specimens. A vasopuncture as just described is, therefore, required. Martin<sup>2</sup> says further: "Before the operation is undertaken strictures, posturethral lesions and chronic inflammation of the seminal vesicles and vas should be cured." He also states that a microscopist should be on duty to show the presence of spermatozoa as a means of prognosis and of determining whether the anastomosis shall be into the epididymis or testis. The instruments and supplies are scalpel, eye scissors and forceps, hemostats, ligatures, small sharp and blunt retractors, eye-needle holder and needles, fine silver wire or silk sutures, drains and dressings with large suspensory bandage. The prepara-

<sup>1</sup> Tr. Am. Assn. Genito-Urinary Surg., 1907, ii, 32. Martin, Carnett, Levi and Warrington, Univ. Penna. Med. Bull., 1902-3, xv, 2.

<sup>2</sup> Loc. cit.

tion of the patient and field are of recognized type and anesthesia local by infiltration of the genitocrural nerve or general in nervous patients. The landmark is the posterior border of the testis and the epididymis for the incision which crosses the skin and superficial fascia of the dartos as the superficial field and thus reaches the outer side of the sexual gland and spares the spermatic artery and the artery of the vas, which are pushed aside in the deep field. The vas is opened at the level of the globus major for about one and a half inches and then an ellipse is cut out of the head of the epididymis in general correspondence with such incision. Martin<sup>1</sup> believes it is better to cut the vas obliquely, split it upward for a quarter-inch and sew this widely stretched lumen to the opening made either into the epididymis, or if spermatozoa are not found there, into the testicle. Immediate microscopical examination should be done to decide this point. Four sutures of silver wire or fine silk make this union, one at the upper and lower limits of the wound and one at each side. After this the skin wound is stitched in the usual manner without drain, unless a small rubber tissue wick is used for twenty-four hours.

The *immediate aftercare* aims to secure primary union by maintaining an evenly arranged dressing under gentle pressure and the *remote after-treatment* does not neglect examination for spermatozoa which may appear early or late. The posterior urethra, as stated in the paragraph on selection of case on page 161, should be as far as possible cured before and not after the operation. The comments are caution as to traumatism of the veins which leads to thrombosis, pain and delay in recovery, as to traumatism of the arteries which may produce loss of the testis, and as to demonstration of living spermatozoa and patency of the vas before selecting the point of anastomosis or completing the operation. The dangers to life or the testis are *nil*, if none of the above accidents happens and the end results in properly chosen cases are a return of living spermatozoa within a few days or weeks or months.

*Cure.*—Pathologically, in the absolute sense cure is rare and in only mild cases, but in partial degree, is common even when occlusion does not occur, although infiltration remains. There is failure when occlusion is present and the testis does not functionate except in its systemic influence. Symptomatically there should be no pain, little or no nodule in either the globus major or minor and no absence of semen in the author's seven-glass test, which is of special value in such cases. Bacteriologically there must be no gonococci in the semen secured by the foregoing test or in a condom worn at night to preserve a seminal emission.

## 2. Urinary Forms.

**Significance.**—All urinary complications are major on account the importance of the structures invaded and of the difficulties of cur

<sup>1</sup> Loc. cit.

ich often lead to operative interference. The infection of a posterior urethritis may pass the sphincter of the bladder and invade the urinary organs in regular order from below upward, causing urethrostitis, cystitis, ureteritis, pyelitis, pyelonephritis, separately or variously associated. Ascent of the organisms over the direct continuity of surface is the rule in these cases. Gonococcal manifestations are again accepted and described as the type.

**Varieties.**—Varieties refer to the bladder in urethrocystitis and cystitis, to the ureter in ureteritis and pyelitis, and to the kidney in pyelonephritis and pyonephrosis, as indicated in the clinical section. These may all occur separately or be variously or collectively associated.

**Etiology.**—The catarrhal diathesis producing a favorable soil and low systemic resistance to disease permitting rapid progress are predisposing conditions. Direct extension of the organisms, most commonly the gonococcus in pure or associated infection from the posterior urethra into the bladder and thence upward, is the exciting cause. The gonococcus renews its activity during an exacerbation of a posterior subacute or chronic urethritis, or invades upward through its native virulence during an acute attack. Artificial extension proceeds from sounds, urethroscopes, cystoscopes and catheters, irrigation of the urethra under high pressure and with strong applications, all producing subacute or acute catarrhal inflammation which immediately affects the gonococcus. The author's irrigation sounds are of value as preventives in that the filling of the bladder with a mild antiseptic through the channel of the sound not only sterilizes and washes the bladder free of any pus inadvertently dragged into it but also cleanses the urethra from behind under Nature's own muscular adaptation. These sounds are described in Chapter VII on page 370. Similar in action is local congestion due to exposure to cold, excesses in food, drink and intercourse and the agitation of horseback, bicycle, automobile and railroad riding.

**Prophylaxis.**—Prophylaxis in general applies to the group as a whole, because if the bladder is once invaded extension is apt to occur by way of the blood-current, the lymph-current and the mucosa in direct continuity, especially if the ureter mouths are patent. Urinary antiseptics during any sign of irritability are indicated to increase the acidity which is germicidal. The symptoms must not be augmented. Artificial extension should be guarded against, whose elements are detailed in the clinical section with reference to instruments (page 506). All excesses in food, drink and sexuality should be forbidden. Abortion is rarely possible but suitable treatment will prevent a urethrocystitis from extending to the bladder as a whole and confine a cystitis within the scus from reaching the ureters or kidneys.

### GONOCOCCAL ACUTE URETHROCYSTITIS.

**Definition.**—As the term indicates, urethrocystitis is infection of the anterior urethra and bladder, of which the latter element is limited

to the cervical portion in the retropubic and ureterotrigonal quadrants, particularly the trigonum. From this origin the inflammation may cause a generalized cystitis, which is a subject in itself.

**Varieties.**—Forms are seen primary and secondary in origin, acute, subacute and chronic in course; nongonococcal and gonococcal in bacteriology. The chronic lesions belong to their own subject in this work and the nongonococcal may in description be merged with the gonococcal, which gives the most severe type alone or combined with other organisms, notably the pyogenic bacteria and *Bacillus coli communis*.

**Pathology.**—The details given under Cystitis on page 167, to which the reader is referred, apply here. The sole exception is the distribution which in this case is in the annexa of the neck in the retropubic and ureterotrigonal segments.

**Symptoms.**—The condition is regularly secondary to antecedent complicated or uncomplicated posterior acute or chronic urethritis. Primary causes are not seen excepting in tuberculosis and neoplasm and the congenital deformities, which are treated under Cystoscopy on pages 767, 775 and 781. The disease has stages of infection, establishment and termination, of which the invasion is so insidious and brief that it merges with the establishment, so that when the patient complains of symptoms the objective proof of the disease is already fixed.

The conditions are subjective and objective, local and systemic. The local subjective symptoms are frequency, tenesmus, terminal pain, pus and blood and at times retention. The frequency augments and continues the same symptoms of the antecedent posterior urethritis. The tenesmus arises from the inflammation over the muscle, giving the sensation of "unfinished business" after urination. The terminal pain and usually the bleeding also are due to the pressure of the sphincter muscle upon the inflamed mucosa, while the pus is either the last dregs in the bladder or actually expressed from the mucosa. Retention arises from extreme edema and may require judicious catheterization.

The objective symptoms are best obtained by intelligent use of the author's seven-glass test. The anterior urethral and the control anterior urethral specimens in the first and second glasses, respectively, indicate the lesions of this part of the canal. The third or posterior urethral glass develops the lesions there with the aid of the microscope. The passage of a small rubber catheter brings the pus, mucus and detritus, sedimented at the neck of the bladder, through the urethrocystitis. These may be followed by relatively clear urine from the bladder. Irrigation of this viscus until it is clean, followed by full distention and suitable massage of the prostate and the seminal vesicles each in its turn, procures the prostatic and the right and left vesicular glasses as the fifth, sixth and seventh specimens and proves the condition of these organs. Sedimentation shows a thick layer of pus at the bottom of the glass followed by a thinner blood-stained or blood-filled layer, next mucopus and finally mucus. Chemical analysis

usually shows acid urine, sometimes alkaline from blood, nuclealbumin from the pus and seroalbumin from the blood and no casts or other renal elements. Bacteriologically gonococci may be found in smear and culture, very often associated with other organisms, as stated, and microscopically are seen epithelia from the posterior urethra and neck of the bladder, pus, blood and mucus in strings and slugs. When the lesion is not overactive a cystoscopy will reveal a localized inflammation in the neck of the bladder and the same observation may be made with the cystourethroscope by penetrating the bladder with it and exploring the neck and the ureterotrigonal and retropubic segments as a preliminary of urethroscopy.

The stage of termination is completed first in the subjective, then in the objective symptoms. All complaints cease usually before the urine is free of objective bladder elements, especially squamous epithelia, which may persist for some time. The urethral discharge, which usually decreases during severe acute urethrocystitis, reappears when the latter subsides, exactly as it does during the acme and subsidence of any other severe complication. A few cases extend to all four zones of the bladder—namely, the urachal, retropubic, ureterotrigonal and the subperitoneal, and then terminate as a general cystitis does or become chronic for life. A still smaller number of urethrocystites may become chronic and without termination, and catarrhal and other diatheses may produce relapsing cases difficult to cure.

**Gonococcal and Chronic Subacute Urethrocystitis.**—The form of subacute urethrocystitis is so mild as to have no subjective symptoms over and above those of the antecedent urethral lesions. Objectively the bladder findings are present, which indicates that when a posterior urethritis is slightly atypical, the urine should be examined for bladder epithelium—a wise rule with every such urethritis.

The subject of gonococcal chronic urethrocystitis is reserved for Chapter IV on Chronic Urethritis, on page 328.

**Diagnosis.**—Rapid ascent of the gonococcal infection through the anterior urethra and into the posterior portion marks the history, with vicious symptoms of involvement of the neck of the bladder, such as great functional, sexual and urinary disturbances. Both these reflexes are stimulated and irritated in high degree. Occasionally there is a history of instrumentation. Symptoms are frequency of urination, tenesmus, terminal pain, pus and blood, and sometimes temporary retention. Systemically the patient shows nervous inquietude, chills, fever and prostration with the usual other train of symptoms incident to infection and absorption. As a rule, such symptoms are less severe than in complications in the prostate, seminal vesicles, testicles and generalized cystitis. Physical examination through the rectum on a full bladder may show great tenderness above the prostate around the neck of the viscus. Only in the declining stage may cystourethroscopy or cystoscopy be advisedly attempted. The three-glass test will show pus in all specimens and much that is thick and blood-stained in the last glass. The seven-glass test of the

author may be carried out with caution in mild or subsiding cases and will show in the fourth or bladder glass, if divided into two specimens, most pus in the first drawn off from the trigonum just as the catheter enters the bladder and perhaps comparatively clear urine in the second flow. The prostatic and the two seminal vesicular glasses may be normal except for the presence of pus and other elements from the posterior urethra. In the laboratory on sedimentation, pus at the bottom of the glass is usually followed by layers of bloody mucopus, mucopus alone, mucus and pus more or less separated, depending on the severity of the lesion. The microscope will show that this detritus consists only of bladder elements and excludes casts and other renal factors. The amount of albumin in the urine is little and due to the pus, in comparison with albumin due to nephritis by the process of transudation. Treatment by irrigation of the bladder until cleansed, followed by the instillation of mild stimulating antiseptics and sometimes even application to individual points through the cystourethroscope, adds the final proof of diagnosis. Attention to the urethritis is also important because it removes the original source of extension of the disease.

**Treatment.**—The correlation of urethrocystitis and cystitis renders essential the discussion of their treatment under Cystitis at the end of this topic on page 173.

### CYSTITIS.

**Definition.**—Inflammation of the bladder is by definition cystitis when it involves the mucosa as a whole, although it may be more severe at some than at other points, notably about the neck in the ureterotrigonal and retropubic quadrants.

**Varieties.**—Classification respects primary and secondary as to origin, acute, subacute and chronic as to course, mild and superficial, severe and deep or parenchymatous, intense and ulcerated as to degree, and finally complicated and uncomplicated as to added lesions. Primary cystitis does not concern the purpose of this work, so that the secondary form with antecedent lesions of the urethra alone will be considered.

**Etiology.**—As a complication or sequel of posterior gonococcal acute urethritis, cystitis may occur, but relatively infrequently, or it may arise in the course or during an exacerbation of posterior gonococcal chronic urethritis. In either case the antecedent is a very severe and usually complicated manifestation of the disease. The systemic and local, predisposing and exciting causes duplicate those given under urethrocystitis, of which the cystitis may be only a later generalization. The essential exciting cause is the gonococcus producing the inflammation taken as the type, rarely in pure, more often in associated culture, especially in the older cases in which it may be impossible or very difficult to find the gonococcus in direct proportion to the age of the case. The associated organisms are commonly the catarrhal and pyogenic cocci, *Bacillus coli communis* and *Micrococcus ureæ*.

**Pathology.**—In the nature of the disease the lesions are judged chiefly from cystoscopic findings and are really added to the pathology of the antecedent urethral conditions. The essence is a gonococcal invasion of the bladder mucosa as a whole, sometimes without, more frequently with other organisms, characterized by congestion, edema, desquamation and infiltration, pus and blood and, in severe cases, by ulceration. The tissues involved are in mild cases the epithelial and subepithelial layers, beyond which no extension may occur; but in severe cases, the bladder wall as a whole may become more or less diseased, especially in localized spots, forming ulcers of variable extent and depth. The macroscopic appearance shows the mucous membrane red, raw and thickened, rough and pus-covered, bleeding and ulcerated, while the microscopic features are the same as in other gonococcal conditions—denuded epithelium, infiltration with small round cells into the submucosa, associated, of course, with the congestion, pus, bleeding and ulceration. Temporary lesions occur only in the mild superficial cases and are the least frequent, while much more usual are the severe cases with permanent lesions, such as hypertrophy, trabeculations, sacculations, contracture with deformity and scar of ulcers. Persistent, subacute or chronic, purulent cystitis may also be the outcome. Complicating lesions are ascending ureteritis, pyelitis, pyelonephritis and ulcerations of unusual depth and the antecedent urethral disease with their complications are the only associated lesions.

**Symptoms.**—Distinction is drawn between subjective and objective, local and systemic manifestations and between the periods of invasion, establishment and termination. In general the syndrome is the same as that of urethrocystitis only in more severe degree. The stage of invasion is masked if it occurs strictly during a posterior acute urethritis; but may be marked if instrumental infection of the bladder is responsible. It is characterized chiefly by uncontrollable uneasiness and rapidly progressing pollakiuria and increasing pus in all, especially the last test-glass. The period of establishment has, as in all infection in variable degree and relation, these subjective and objective systemic symptoms: chill or chilliness, fever, malaise, prostration, anorexia, nausea, vomiting and constipation, with willing confinement to bed. The cardinal symptoms are pollakiuria, tenesmus, dysuria, pain and blood in the systemic subjective group and tenderness, pyuria and hematuria in the local objective group. The pollakiuria is every few minutes, by day or night, even up to fifty to sixty times in twenty-four hours in extreme cases and thirty to forty times in early average cases. It is decreased by rest in bed, which carries the urine away from the neck of the bladder, where its presence in the erect posture adds to this worry. The tenesmus is due to the irritation of the muscle by the inflammation, so that when the bladder is empty the reflex effect of fullness is still present. This symptom is often very hard to bear. The dysuria is usually due to the edema at the neck of the bladder and in rare cases induces temporary retention of urine or it may be due to the antecedent urethritis with complicat-



ing prostatitis. Its degree may only involve the changes in the form, force and trajectory of the stream. The pain is due to the severity of the inflammation, the congestion and pressure on the inflamed surface by the accumulation of urine and the muscular effort of evacuation, especially of the last drops. The irritation of decomposing urine is also a source of pain. The pain occurs, therefore, before, during and after urination, by day or by night, is more or less constant with paroxysms, increased by the erect posture and motion, decreased by rest in bed. Blood in the urine may proceed from rupture of capillaries, by severe turgescence, by muscular action of the bladder or by ulceration. It is usually terminal in its appearance and spasmodic in its source and not great in quantity, as a rule. Tenderness on palpation and percussion over the bladder demonstrate not the viscus which is usually empty but the reflex muscular rigidity over any inflamed organ. The altered urethral discharge is noted as decreased during the acme of the cystitis, and pyrexia as containing much pus and some blood. The three-glass test gives the most pus in the first and third and least in the second glass. The first glass brings away sediment near the neck of the bladder and is, therefore, usually very thick with pus. The second glass contains the pus as it is mixed uniformly with the urine, which while abundant is not so thick as in the first and third glasses. The third glass through the terminal compression of the bladder often contains the most pus and almost always the most stringy mucus.

The seven-glass test of the author is available if the case is not a severe one, so as not to contraindicate the use of catheters and to permit the passage of small ones. The first or anterior urethral glass with the second or control anterior urethral glass vary with the degree of anterior urethritis present. The third or posterior urethral glass will have its characters changed by the pus from the bladder but the microscope will often distinguish the presence of prostatic or other posterior urethral elements. The fourth or catheterized bladder glass will with the first flush bring away much stringy mucus and pus from the floor of the bladder and immediately thereafter the more even mixture of pus and urine and the last few drops will be again thick and stringy. The fifth or prostatic glass, the sixth or right seminal vesicle glass and the seventh or left seminal vesicle glass are obtainable after washing the bladder until it is quite free of pus and then by massaging each of these organs in turn for its own specimen. The value of these last three glasses is in demonstrating the presence of associated lesions in the prostate and the seminal vesicles. Sedimentation of the specimen of urine is the same in kind but greater in degree as that described under Urethrocystitis. Analysis shows the reaction acid or alkaline at first and later alkaline, always through mixed infection. Some cases remain acid throughout. The albumin is nuclealbumin of pus and seroalbumin if blood is a factor. These are differential points. The microscope reveals in a catheterized specimen abundance of bladder elements, but absence of urethral and

renal elements. Red blood cells are present in quantity according to the hemorrhage present.

The stage of termination leads to total recovery, relapses or chronic cystitis. Full cure is seen only in the very mild superficial cases, which leave behind no damage of clinical importance. The average case, however, does show damage and leaves a bladder of low resistance to subsequent infection and relapses of the original infection which may be troublesome for the patient for years or even life. Chronic cystitis is a very common outcome of severe cases with deep damage and ulceration and in patients with relatively poor systemic resistance to all infection. These are the bladders showing contracture, deformity, trabeculation and sacculation and easy prey of tuberculosis later in life. The acute stage of cystitis with intense suffering begins to subside in from seven to ten days, while the subacute declining period extends from thirty to sixty days. Even after this caution by the patient is often necessary. Early correct diagnosis, prompt and proper treatment, full and faithful coöperation by the patient are the ground work of cure.

**Complications.**—Infection of the bladder may extend up the ureter, on one or both sides, causing the complications of ureteritis, pyelitis and pyelonephritis. Such extension is most common when urethral obstruction exists, as in organic stricture or prostatic disease upon which acute gonococcal infection has been ingrafted and thereafter is profoundly affected the bladder.



FIG. 52.—Gonococcal acute cystitis, showing universal redness, absence of blood-vessels, great edema, loss of normal elasticity and gloss, infiltration of the mucosa into cerebriform convolutions and folds. A string of exfoliated epithelium, mucus and pus stretches across the field. (Marion.<sup>1</sup>)

**Diagnosis.**—Full clinical explanation of *acute cystitis* lies in the histories of direct extension from a severe rapidly advancing antero-posterior urethritis, of the predisposing catarrhal diathesis or of official extension by various instruments and irrigations, for the secondary cases. Primary causes are seen in the differential diagnosis tuberculosis, neoplasm, deformity of childbirth and calculus.

<sup>1</sup> Marion, Heitz-Boyer and Germain, *Cystoscopie d'Exploration*, 1914.

The symptoms, systemically, are those common for infection—chills, fever, prostration, digestive disorder, high pulse, and locally pollakiuria, tenesmus, dysuria, pain and blood, tenderness on palpation through the bladder or rectum. Objectively in the multiple glass test the bladder glass has most of the pus but all glasses have abundance—a fact arising from final expression of its contents. In the seven-glass test of the author during the stage of subsidence, a soft catheter may be gently passed for the bladder glass which will be shown to contain all the pus with the sole exception of that irrigated from the urethra. In the laboratory, sedimentation gives a thick layer at the bottom with thinner blood stained or blood filled layer next, then pus or mucopus, and finally mucus and after a while comparatively clear urine. The microscope reveals bladder elements, to the exclusion of casts and other renal elements and smear and culture demonstrate the gonococcus. Albumin is in relatively small quantities, thus distinguishing it from albuminuria of nephritis. Exploration of the bladder with the cystoscope or cystourethroscope is contraindicated until the stage of termination is nearly established. If necessary, in the earlier periods they must be used with great caution. Microscopy shows bladder epithelium, urethral epithelium and fresh pus in the recent case, especially with pure infection, but deformed pus and epithelia and abundant phosphates in old cases commonly with mixed infection. It must be borne in mind that turbidity of the urine may be due to pus, carbonates and phosphates as admirably shown and distinguished in the following table of Ultzmann.<sup>1</sup>

TABLE OF URINARY TURBIDITY TESTS.

In pyuria by gradually boiling the upper part of the urine in a test-tube the turbidity

Vanishes.	Increases.			Remains unchanged even after addition of acetic acid.
If due to acid urates.	If due to earthy phosphates, carbonates or pus corpuscles. Add one or two drops of acetic acid.			The dimming is caused by catarrhal secretion or by bacteria.
	Dimness vanishes with evolution of gas: carbonates	Dimness vanishes without evolution of gas: phosphates	Dimness remains unchanged: pus	

Further in the diagnosis, treatment of the urethritis removes the origin of the extension and is of direct benefit to the cystitis, but standard methods of treating the bladder with urinary antiseptics internally and with irrigations, instillations and applications locally still further demonstrate the case.

<sup>1</sup> Vorlesungen über Krankheiten d. Harn., 1892, p. 3.

**Diagnosis.**—In *chronic cystitis* an acute attack during a severe urethritis or direct instrumental infection or hematogenous infarct is recorded by the history or frequent attacks, without definite relief but with a more or less incessant exacerbating condition. Other forms show periods of apparent cure, then a reinfection without known cause. Thus the salient subjective and objective systemic symptoms are declining or absent. The subjective symptoms are never acute unless an exacerbation is present but signs of absorption and a low-grade septic state may be predominant with low degrees of pollakiuria, tenesmus, dysuria, pain and blood and objectively pyuria, hematuria, the bladder glass filled with vesical pus in the seven-glass test of the author, and the cystoscopic and urethroscopic findings are absolute, because they eliminate the urethra, prostate and seminal vesicles as sources of the pus. The laboratory reports abundant sediment of vesical origin in the specimen, discovers the gonococcus on smear and culture and the positive complement fixation test in the blood. Treatment directed to the bladder alone in the form of irrigations, instillations and applications or to the urine through the blood by urinary antiseptics helps settle the question, along with gonococcal or mixed bacterins in some cases. Drainage of the bladder is absolute in diagnostic and curative results.

**Differential Diagnosis.**—Differential diagnosis rests on the use of the cystoscope and is fully discussed in the section on Cystitis in Chapter XIV on The Bladder (page 770), which deals with the distinguishing features of the common varieties—nonsuppurative and suppurative, membranous, ulcerative and necrotic, neoplastic, calcareous, tuberculous, colon bacillary and finally regional, disseminate and general.

Gonococcal cystitis must be distinguished from pyuria arising in other forms of vesical inflammation, in posterior urethritis below it and in the ureters and kidneys above it in the various degrees of pyelitis, pyelonephritis and pyelonephrosis.

Other varieties of cystitis to be considered are suppurative, tuberculous, calculous, neoplastic, and diverticular, all whose details are set forth under Cystoscopy on page 761, but whose general features are these following. In their histories antecedent inflammation of the urethra and its annexed sexual organs is absent so that extension into the bladder in continuity or infection through instruments is excluded. Suppurative cystitis is with difficulty distinguished from gonococcal except with the microscope and is the one form which may be secondary to a suppurative urethritis. Tuberculosis of the bladder is insidious and prolonged in history and in this respect is closely followed by neoplasm. Stone in the bladder is usually preceded by gravel and other signs of lithiasis. Diverticulum may give periods of comparative rest followed by floods of pus. Symptoms of suppurative disease almost duplicate those of gonococcal cystitis while tuberculosis is the most painful and hemorrhagic. Neoplasm in general is that of a foreign body followed by ulceration and slough. Calculus shows the pain and frequency, pressure and hemorrhage of the stone and always of the

pus which accompanies it. A diverticulum may cause constant cystitis or while filling up may for a few hours permit relatively clear urine. On examination through the rectum the tenderness and infiltration of tuberculosis and neoplasm and the resistance and ballotement may be elicited. Cystoscopy will invariably distinguish the five conditions from each other even at the first sitting in details given in Chapter XIII, from pages 761 to 806. Catheterization of the ureters and a suspected diverticulum will verify the latter. In the laboratory all refinements of examination of pus, detritus, fragments and other specimens will settle the question. Animal inoculation is sometimes necessary in tuberculosis. In the treatment final proof is obtainable in some cases of uncertainty as special means directed toward each bring results. Irrigation and antiseptics benefit suppuration, while tuberculosis and neoplasm are very intractable, especially the latter. Removal of the calculus and treatment of the suppuration remaining behind cure the bladder. Cystotomy and removal of the diverticulum alone avails in its advanced forms.

*Posterior urethritis differs from gonococcal cystitis* in that it precedes any bladder involvement in the regular sequence of rapidly ascending anterior urethritis. Although many symptoms of cystitis may occur, the lesion may be absent. Those of posterior urethritis are always much less in degree and usually of shorter duration. Systemic signs are absent or few and slight and local conditions, such as pollakiuria, tenesmus, and dysuria, persist for only a few days. Pain and tenderness in the bladder over the symphysis and through the rectum are usually absent, likewise blood in the urine. The ordinary three-glass test shows pus in all but most in the first and least in the third which reverses the findings in cystitis and the seven-glass test of the author always gives the bladder glass by catheter clear, but such specimen should be taken only in the declining period. In the laboratory the microscope will show only posterior urethral elements with none or very few bladder signs. If complications in the prostate and vesicles are present then specimens from these sources will also be there.

*Pyelitis, Pyelonephritis and Pyonephrosis Differ from Cystitis.*—Unless careful analysis of each case is made pus found in the bladder will be regarded as originating there instead of in the kidney or ureters. In the history, cystitis gives no element of diathesis or low resistance, previous inflammation or other conditions leading to the kidneys in the primary cases. In the secondary or ascending cases which follow a cystitis, this record is reversed. In the symptoms, subjectively, during distention and evacuation the bladder gives pain and distress in its own zone of the body above the symphysis and in the perineal and anal regions, at times with the urethra. Renal pyuria is either painless or refers the symptoms to the renal zone below the ribs near the spine behind and the hypochondria in front or the course of the ureters. Objectively, rectal examination in cystitis elicits pain, tenderness and sometimes prostatic engorgement, but in renal conditions negative signs. Abdominal palpation in cystitis reveals a tender



thickened bladder and nothing in the kidney and ureteral zones, but in kidney lesions the bladder is usually negative while the ureterorenal regions show pain, tenderness and enlargement. Cystoscopy in cystitis gives typical findings with clear urine from each kidney, whereas in renal disease one or both ureteral mouths may be profoundly changed and show an outflow of pus or bloody urine or no urine. Catheterization of the ureters will further distinguish the point of chief involvement, and the dye tests will show the comparative function between the two sides. In the laboratory sedimentation is rapid in cystitis and the urine usually alkaline and less commonly acid, but the pus of kidney lesions is more frequent in acid urine of recent cases and less so in alkaline urine, except in old cases. Renal pus, moreover, settles out much more slowly with somewhat less distinction as to layers. Albumin is marked in kidney disease but slight and proportional with the amount of pus in inflammation of the bladder. The microscope detects only bladder epithelia and other elements in cystitis to the exclusion of kidney signs but the reverse when the latter organs are involved, so that then casts and all forms of ureteral, pelvic and tubal epithelia are abundant. The radiograph will sometimes reveal changes in the size, form and contents of one or both kidneys especially if injected with impervious fluids like the more modern silver salts. Stones, if present as the source of the infection, are almost always detected by the procedure.

**Treatment of Gonococcal Acute and Chronic Urethrocystitis and Cystitis.**

—These two lesions should be grouped together as cognate and differing only in degree and duration of treatment and significance makes the urethrocystitis relatively rather minor until it merges into a cystitis as distinctly major. The prophylaxis heads the earliest sign of invasion of the bladder by immediately applying the subjoined elements of treatment and especially by rendering the urine antiseptic and aseptic. Early and proper attention to posterior urethritis, as fully described on page 76, is also preventive, while abortion is possible by lavage of the bladder during acute retention often seen in severe posterior urethral lesions. Any invasion of the bladder during infection of the urethra must be followed by irrigation, retention of mild antiseptic fluid and retrojection with it and by the administration of suitable urinary antiseptics.

Brevity requires reference to Chapter IX on General Principles Treatment for description of management on page 483.

*Curative Treatment.*—Too much stress cannot be laid on the special features of each case.

The physical measures are comparatively of little influence until later, especially massage, which is an eliminant in the toxic cases. Cold and heat locally applied with the ice-bag or poultice represent hydrotherapy. Rectal irrigation with cold or hot fluids will quiet the irritation and tenesmus, while hot sitting baths reduce the deep pelvic congestion. Hot body baths and Turkish baths stimulate perspiration and elimination to great advantage in severe absorptive cases.

The application of light is, as noted on page 188, a convenient means of local heat to the perineal and suprapubic regions in long and frequent sittings until the skin is very red. In acute cases it is a sedative and decongestant and easy for the patient to use himself.

The electrotherapeutics require a multiple plate, high-speed static electrical machine developing up to 5 milliamperes of current and a 7 inch to 8 inch x-ray tube capable of backing up 50,000 volts. The intensity of current is measured at from 2 to 5 milliamperes, the distance from the part is 10 inches with filtration through 3 mm. of aluminum combined with either 4 thicknesses of chamois or one thickness of sole leather. The duration is twenty minutes and twice a week is the frequency. The action is inhibitory on the organisms and stimulant of resorption of the exudate. A series of twenty treatments should be given, repeated after two weeks, and in the interval heliotherapy may be applied.

The medicinal measures in all known means by systemic administration are employed to combat absorption and toxemia, to render the urine antiseptic against extension of infection to the kidneys and to stimulate the mucosa to improved action especially during the declining periods. The drugs are the same as those recommended for the medicinal measures for urethritis on page 67.

The serotherapy is not encouraging, but is more so in subacute and chronic than acute lesions. In particular the negative phase must be guarded against and the serum is preferred for passive immunity and the bacterin, either autogenous or heterogeneous or mixed, as Van Cott's, is given for active immunity. No such remarkable results as in diphtheria may be expected but many cases are aided by properly graduated and increasing doses, as mentioned in this subject in Chapter IX on General Principles of Treatment on page 513.

All local administration during acute symptoms should be stopped and only in the subacute declining stages may vesical irrigation be begun—most advisedly with the soft catheter-syringe method, always after the patient has urinated to cleanse the urethra. Lavage is made in small quantities, from 30 to 100 c.c. (1 to 3 ounces), at each filling at first, heated to easy tolerance from 95° to 110° F., of nonirritating chemical character, such as normal salt solution, boric acid water 2 to 4 per cent., nitrate of silver 1 in 20,000, potassium permanganate 1 in 20,000 to 10,000, argyrol 3 to 10 per cent. and similar familiar solutions. Washing is continued with the solvents of pus, such as the first two solutions, until the return fluid is clear, showing that the mucosa is freed of exudate and then antiseptic and the astringent solutions, such as the last three formulas, are used and commonly a fourth or third of the bladder capacity is left in for more prolonged action. There must be only trivial pain, spasm, tenesmus or other reaction and the retained fluid when evacuated is a retrojection for the urethritis and therefore has double function. The frequency of lavage is at first twice a day, then once a day and next alternate day and finally longer intervals determined by the power of the bladder.



throw off accumulated pus. Instillation of the deep urethra and even the neck of the bladder in the later stages of cystitis may be begun with advantage according to indications and results. The fluids and strengths duplicate those given under urethritis. With discrimination this treatment is almost abortive of urethrocystitis in the earlier period. When the cystitis is far declined urethral irrigations by the surgeon and hand injections by the patient may be with caution instituted to avoid any disturbance or relapse of the cystitis. Again the catheter-syringe method is the choice.

The surgical treatment is nonoperative and operative. The non-operative surgical measures apply to the early symptom of acute retention by catheterism at one or a few sittings in mild attacks or by a retention catheter in severe cases to avoid frequent incursion of the viscus, combined with the same gentle irrigation just described. Instrumentation is very late, only after the cystitis is almost well, and the author's sound is best in combining gentle dilatation of stricture antecedent to the posterior urethritis and its complicating cystitis with lavage of the bladder, retention of medicated fluid and retrojection of the same. All the principles are the same as those given for urethral irrigation, instrumentation, and dilatation with mechanical methods on page 365.

The operative surgical methods are reserved for failure of all other means and the terminal stages. Through the cystoscope and cystourethroscope, as defined in Chapters XII and XIII on pages 653 and 682, applications may be made to the mucosa of sedatives, stimulants, astringents and caustics and even the high-frequency current of Oudin to localized patches of rebellious inflammation and indolent ulcers always within any severe reaction or relapse. Ureteral catheterism will determine involvement of the kidneys and should be carried out with the technic detailed under this subject on page 821. Careful lavage and reasonable sterilization of the bladder are essential preliminaries. The minor operations include only suprapubic aspiration in cases of severe retention, from a stricture impassable to a catheter. Suprapubic aspiration is only required in a bladder known to be distended well above the symphysis pubis by inspection, percussion and abdominal and rectal palpation. Strict asepsis and antisepsis as to the skin of patient and surgeon and the instruments and supplies with the patient supine. After local anesthesia and a small trocar and cannula or an aspirating needle with syringe is entered just above the symphysis and pointed 10° to 15° downward and backward and carried into the cavity of the bladder practically at the upper border of the bones. The trocar is then removed for free outlet of the urine under pressure of the distention or if it does not flow through the aspirating needle suction with the syringe will start it. If distention has been extreme only about half should be withdrawn, otherwise hemorrhage into the bladder may result from undue removal of pressure from the capillaries. After withdrawal of the instrument there is usually no leakage or infection of the cellular planes, especially if the needle is chosen. A small dressing



with collodion is sufficient. This relief of the bladder combined with other measures will often make an impassable stricture passable or remove other cause of the retention and permit other forms of treatment. Major operations are perineal drainage through a combined internal and external urethrotomy or through the "button-hole" operation or a suprapubic cystotomy.

*Urethrotomy* is described under the Treatment of Stricture on page 390 and need not be repeated here.

*Suprapubic cystotomy* contains the following details: It is less frequently done than perineal drainage and in selection of case respects those benefited by topical applications as part of the procedure. As in any laparotomy the instruments and supplies are scalpels with short and long blades, scissors, hemostats and ligatures, forceps and retractors both sharp and blunt, long and short blade, illumination for the cavity of the bladder, needle-holder, needles and sutures, drains and dressings. The preparation of patient and field is standard for any major operation and the anesthesia may be local with careful infiltration of the nerves of the skin and muscle planes and the posture is supine, giving the landmarks of the symphysis pubis below and the umbilicus above for the incision, which passes above the former for about three inches in the middle line through the superficial field between the rectus muscles down to the extraperitoneal fat. Hemostasis and retraction follow and then the fingers in the deep field are passed laterally to reach the fold of peritoneum as it turns forward and inward over the viscus and makes an interval easy of detection and separation from the bladder so that freedom of its transverse border is immediate. A needle with stout silk suture is now passed into the bladder high up on each side as elevators and retractors between which a stab of the bladder is made and the outflow caught on gauze. Careful diagnosis and treatment of the urethral condition must be made from within the bladder forward as part of this operation, as discussed under Treatment of Stricture by the Retrograde Operation after Cystotomy on page 402. As little separation as possible of the bladder from the symphysis is made so that the deep field is above and not behind this joint and pocketing of drainage is avoided. After suitable enlargement of the wound in the bladder and inspection and suitable applications or other required treatment to its cleansed cavity are made, the drainage tube is inserted and the wall stitched with two or more layers of Lembert mattress sutures down to it. The tube is stitched to aponeurosis, fascia or skin with light catgut and the abdominal wound is reasonably closed with layer sutures of catgut and silkworm gut for the skin. A large standard dressing receives the drainage or one of the various suction devices may be attached to the tube to keep the bladder free of accumulation.

*Aftertreatment.*— Immediate steps secure regular drainage of the bladder associated with irrigation as already described and with urethral treatment as required, and dressings changed every two to four hours for absolute freedom from decomposing urine. The drain

removed on the third to the seventh day and the skin stitches on the seventh to tenth day if possible. Nursing, diet and medication are according to indications. Remote aftercare prevents relapse of urethral conditions from which the cystitis arose and any cause tending to reproduce the cystitis. After secondary intention has healed the wound, therefore, all the aftertreatment of stricture and posterior urethritis, given on page 399, and that for cystitis, stated on page 329, must be in evidence as prophylaxis of persistence or relapse. The comments acknowledge that this operation is without much danger, but must have the caution of not wounding the peritoneum. Shock is minimal, benefit great and end results of great value, often preventing a pan-cystitis with contracture.

Constitutional aftertreatment of cystitis is sufficiently indicated in each of the foregoing measures and includes fit attention to systemic causes and to local causes. These are enumerated in the clinical section but of special importance are restoration of the bladder and urethral mucosa to as near their normal condition as possible and the relief of pus foci in the prostate, seminal vesicles, posterior urethra and finally in stricture formations. Any such lesions persisting largely defeat the result because they invite active relapse within themselves and within the bladder.

*Cure.*—Cure pathologically can occur only in the mildest cases. The process may be checked so that normal physiology results and only scattered sequels such as infiltrations remain. Symptomatically in general a weakened bladder results so that any exciting cause, such as diet, drink and exposure to cold, may be followed by a relapse particularly if the patient has a catarrhal or other tendency. In the severe cases mild relapses are very frequent and a few patients have a sub-cystitis more or less constantly without other disadvantage. In other words, like every other mucosa that of the bladder may never really recover if deeply damaged. Bacteriologically disappearance of the gonococci is most important together with its pyogenic allies.

#### URETERITIS, PYELITIS AND PYELONEPHRITIS.

*Occurrence.*—As complications of posterior gonococcal acute urethritis these three conditions are rare and regularly caused by invasion of kidney, pelvis and ureter on one or both sides by the gonococcus, in pure culture least commonly, but in mixed culture most commonly. As in so many other urogenital infections the *staphylococcus*, *streptococcus* and *Bacillus coli communis* of the pyogenic group are the usual associates.

*Definition.*—Strictly infection of the ureter alone is ureteritis, which rarely occurs excepting with the pelvis, constituting pyelitis. Almost invariably the latter term carries with it involvement of the ureter. In ureteropyelitis, therefore, the kidney substance itself escapes more or less fully. Pyelonephritis means involvement of the parenchyma

of the kidney in the infection, so that signs of inflammation of the kidney are regularly present.

**Varieties.**—Varieties are considered as primary and secondary as origin; acute, subacute, chronic and relapsing, complicated and uncomplicated as to course; mild, severe and intense as to degree; nongonococcal and gonococcal as to cause; unilateral and bilateral as to location. Of these the primary cases do not concern this work as it deals only with their relation to antecedent gonococcal infection, thus bringing all cases under the secondary class. For the same reason the nongonococcal group may be merged into the gonococcal, remembering that catarrhal pyelitis and suppurative pyelitis have the same but less marked clinical pictures. As to mode of infection ascending cases and descending cases are distinguished. In the former the ureter becomes dilated and the organisms travel upward from the bladder or pass along the lymphatics to the kidney but in the latter the kidney is invaded by bacteria through the bloodstream or the lymphstream and after free production of pus in the urine the process descends along the ureter.

**Etiology.**—As in all infections there are predisposing and exciting local and systemic elements. The predisposing systemic causes are those diatheses which incline through low resistance to infection and catarrhal conditions. Occasionally these become exciting systemic factors. The predisposing local elements are congestion and irritation of the kidney, pelvis and ureter by food, drink, drugs, exposure, exertion and traumatism. Injudicious use of the balsams is not an infrequent disturbance of the kidney. Kidneys depreciated by antecedent medical nephritis or traumatism are much more vulnerable to invasion by the gonococcus and other organisms than are sound kidneys, hence the scarlatinal nephritis of childhood is often a precursor of these complications.

The exciting local factor is regularly the gonococcus, with or without the pyogenic group. The avenues of invasion are the ureter, the bloodstream and the lymphatic channels. (1) Through the ureter the gonococcus ascends from the bladder in continuity of their mucosae, induced by back pressure of obstruction chiefly through stricture, prostatic abscess and hypertrophy. The mouths of the ureters are commonly gaping, their sphincters relaxed and inactive so that an open channel exists from the bladder to the pelvis and the kidney. (2) Through the blood current the gonococcus reaches the kidney as in infecting originating in severe lesions of posterior urethritis and prostatitis. In these cases the pathogenesis is the same as in gonococcal infection of joints, tendon sheaths and endocardium. The absence of cystitis is essential as in this form the nephritis precedes and the ureteropyelitis follows. (3) Through the lymphatic channels the gonococci reach the perirenal substance along the lymphatics which follow the course of the ureter. From foci so established the pus invades the kidney substance so that the nephritis is again the first element and the pyelitis and ureteritis second.



Cases in literature are very frequent and their number might be indefinitely quoted. The following few, however, are proof of the occurrence of this complication either through the gonococcus in pure culture or through its association with other pyogenic organisms. Hagner<sup>1</sup> has recorded 27 cases of his own, 9 with pure and 16 with mixed gonococcal invasion. Sellei and Unterberg<sup>2</sup> report 5 cases of infection of the kidney with the *Bacillus coli communis* and *gonococcus* together. Bransford Lewis<sup>3</sup> discusses the general pathology and subject.

**Pathology.**—The lesions are unilateral or bilateral. Primary cases without known precursor of acute or chronic infective focus are rare and do not concern this work. Secondary cases are the rule, especially after gonococcal cystitis, acute and chronic posterior urethritis, prostatitis and seminal vesiculitis with or without abscess. The exciting organism is the gonococcus more frequently with the pyogenic group than without them. The essence of the process in ureteritis and pyelitis is gonococcal infection of the mucosa and submucosa, characterized by congestion, desquamation, infiltration, thickening, mucus- and pus-formation, bleeding and ulceration, all in severity proportional with the activity of the organisms. The renal substance is hyperemic in sympathy only and does not share directly in the infection. The tissues involved are, therefore, the lining of the ureter, the pelvis of the kidney and its calyces, in the mucosa alone in mild cases or the submucosa and stroma of the canal in severe cases. The temporary lesions are seen only in mild degrees which hardly pass beyond the catarrhal stage, but the permanent results appear after severe or repeated attacks and are characterized chiefly by thickenings, fibrosis, stricture and kinking of the ureter and thickening deformity and sacculation of the pelvis. The associated lesions are practically always the antecedent infections in the distal urinary tract in ascending forms or in the proximal urinary tract, namely, in the kidney in descending types of hematogenous or lymphogenous origin.

The essence of the process in pyelonephritis is a gonococcal attack upon the parenchyma of the kidney, so that the element of infection of the kidney is preëminent. The tissues attacked are the ströma, glomeruli, proximal tubules and distal tubules in a generalized or focalized infection. The abscesses are of microscopic or macroscopic size, in multiple spots and streaks. General nephritis of variable degree may occur in which the epithelium is degenerated, the glomeruli congested, infiltrated with small round cells, hypertrophied or atrophied, the tubules hypertrophied and dilated or atrophied and obliterated and filled with blood, pus and casts. Temporary lesions hardly ever occur as the kidneys are invariably damaged, but the degree may be so slight as to leave physiologically serviceable organs, in that sound portions compensate for lost or damaged areas. The permanent lesions are the scars of the abscesses and the sequels in the secretory portion of the organ just described. The associated lesions are the precursors

<sup>1</sup> Med. Rec., 1910, p. 568.

<sup>2</sup> Berl. klin. Wchnschr., 1907, xlv, p. 1113.

<sup>3</sup> Jour. Cut. and Gen.-Urin. Dis., 1900, xviii, 395.

of the infection in the distal urogenital tract and in the pelvis and ureter in the descending form with the kidney first involved.

**Symptoms.**—There are important differences between the ascending and descending types of the disease.

A. The following conditions are intrinsic chiefly for *ascending infection of the ureter, pelvis and kidney* which commonly proceeds in the order of parts named although the process may be so severe as to constitute one entity. Careful description respects subjective and objective, systemic and focal symptoms during invasion, establishment and termination. All vary with the acuteness and severity of the attack and all are fewest in the mild lesions.

The mild symptoms belong necessarily to the less extensive as well as the less severe lesions and are consequently seen in ureteritis and pyelitis without involvement of the kidney in any process more than congestion. On the other hand, the severe symptoms obviously are inherent in the more profound and intense lesions in which the kidney is greatly compromised, so that these patients, therefore, have all the symptoms of profound nephritis.

1. The period of invasion of pyelitis is not well marked, being as a rule merged with the antecedent source of the gonococci. The systemic subjective symptoms are either practically absent in mild cases or in severe forms follow the rule in most infections with sudden onset of anorexia, nausea, vomiting and constipation, chill or chilliness, fever, perspiration and prostration. The patient gladly takes to bed and appears sick. The local subjective symptoms are discomfort, dragging, positive pain, pollakiuria, dysuria, anuria and referred pain.

In mild cases discomfort and dragging and in the severe cases positive pain are present. Pain in the kidney region on deep inspiration, coughing or other motion is also often complained of. The pain is due to the congestion, the irritation of the urine upon the diseased mucosa and the passage of pus and mucus down the ureter acting much as gravel and calculi do. Pollakiuria is often marked and adds to that already existent from vesicle and urethral conditions. Dysuria is usually of reflex origin and likewise temporary anuria. Pain may be referred to the normal side in unilateral cases and is then due to congestion of the healthy kidney during its compensatory effort. Referred pain may also be sympathetically in the testicle and cord of the same side, and is due to the descent of slugs of pus and mucus, exactly as in migrating ureteral calculi.

The systemic and local objective symptoms of the invasion are very difficult to distinguish from the antecedent condition in the urethra, prostate, seminal vesicles or bladder in either the ascending or descending cases, unless it be perhaps, the conditions within the urine which on analysis reveals the advent of pelvic and at times renal elements previously known to be absent in well-followed cases.

The systemic and local subjective and objective symptoms of the stage of establishment are the same as those just described with the degree much more marked. In fact, it is during the establishment

that the symptoms are usually complained of enough to render the diagnosis positive. The insidious onset and invasion more or less masked by the preceding complicated urethritis render very early recognition most difficult.

2. The *invasion of pyelonephritis* is a much more severe and prostrating condition with all the foregoing symptoms present, including scanty urine, loaded with pus, blood, casts, bacteria, detritus, albumin, and high specific gravity. As a rule it is acid at first, then alkaline as the age of the disease advances. The establishment in subjective symptoms is marked by continuation of the chills or chilliness, fever, debility, pain, oliguria and at times crises of anuria. The picture is one of multiple pus foci in the kidney or of general suppuration of the parenchyma which involves a severe infectious condition with rapid pulse, fever and extreme weakness. If the ureter is draining well and if the pus is evacuated into the pelvis rather freely instead of being retained in abscesses, the symptoms are apt to be less, but if retention is present either through occlusion of the ureter or through phlegmonous nephritis, then the symptoms are all augmented. The pain may be unilateral or bilateral and is greatest when the ureter is blocked and the first steps of pyonephrosis present. Even if one kidney is involved, the congestion of the normal kidney through double duty may lead to pain in it for a time. The pain is referred as in calculi to the loins, down the ureter, to the bladder, testis, penis and even the thigh. The condition of the ureter and passage along it of masses of pus and detritus are probably the origins of these referred pains. Oliguria is seen during the invasion as long as the congestion of the normal kidney in unilateral cases lasts and in bilateral cases until the kidneys may begin to improve. Anuria which may be temporary and then augment all the other symptoms or persistent and then end fatally is not uncommon in extreme cases. Profuse perspiration of the skin always accompanies either of these symptoms. The systemic local objective symptoms of the establishment verify the foregoing conditions as of renal origin. The strength of the patient is on inspection obviously attacked so that he looks feverish, infected, sick and prostrated. Palpation of the kidney zones is not absolutely diagnostic unless the patient is able to relax his abdomen and the kidney is enlarged. Occasionally one or both organs are found enlarged, tense and sensitive with tenderness along the ureter. In unilateral cases the afflicted kidney shows these signs while the normal one may be only tender, and, of course, in bilateral cases these data may be elicited on both sides equally or on one side considerably more than on the other side.

1. Laboratory findings, if the ureter is draining, are a scanty urine of high specific gravity, acid in recent, alkaline in older cases, especially those with retention and decomposition of the urine in the pelvis of the kidney, serumalbumin from the blood and nuclealbumin from the pus, multiple casts, including epithelial, blood and pus casts, pus cells in various stages of degeneration, red blood cells in moderate

or marked amount, mucus and other detritus. The gonococcus in pure or associated culture with many other organisms is present. 2. If the ureter is not draining, then the urine may show only the conditions of the antecedent cystitis in ascending cases or of the previous complicated urethritis in descending cases. With one kidney involved and its ureter blocked, the congested normal kidney may show the characteristic elements of its disturbance.

Sedimentation of the urine shows the usual layers of dense pus and detritus at the bottom followed from below upward by a layer of less specific gravity containing the blood, then one with mucopus and less blood, and finally one of mucus and urine itself.

Cystoscopy may be advisedly done, if the declining stage of the urethritis and cystitis is present. This procedure will settle the diagnosis, especially when combined with ureteral catheterization. The latter step will recognize not only the side affected in unilateral cases but the more involved kidney in bilateral cases, particularly if retention and decomposition are present on one side and not on the other, which would sometimes give respectively alkaline and acid urine.

*B. Descending pyelonephritis, pyelitis and ureteritis* reverse the order of infection of parts and change the clinical picture in the following intrinsic terms. As previously stated, the source of the infection is the blood current or the lymphstream from some active gonococcal focus in the genital system without compromise of the bladder. The renal lesions, therefore, come first, either in the kidney substance itself, or in the perirenal tissues, respectively as multiple or solitary abscess or general suppuration in the kidney or its annexa. From this condition the pus passes sooner or later through the kidney substance into the pelvis, down the ureter and into the bladder, setting up suppuration wherever it reaches. The systemic and local subjective and objective symptoms are the same as those described for the ascending type, except that at the outset there is greater intensity of the renal factor, essential to purulent nephritis. Daily urinalysis will show a profound nephritis even before macroscopic pus appears. After this, urinalysis reveals all the physical, chemical, microscopical and bacteriological features which accompany free pus in the urine. This brings out the practical fact that every case of severe gonococcal infection with confinement to bed requires examination of the urine daily or every other day for the earliest possible discovery of such extensions and involvements of the kidney.

**Termination of Ureteritis, Pyelitis and Pyelonephritis.**—The outlook of complications of gonococcal acute urethritis which involve such organs as the kidneys is essentially grave in virtue of the permanence of damage inherent in the action of the gonococcus.

1. *Pyelitis and ureteritis* in mild forms are followed by complete recovery with no sequels, but such are relatively rare. In the more severe forms a damaged and weakened mucosa remains behind with thickenings and indurations in the ureter or a tendency toward relapses



requent attacks of catarrhal inflammation. From this basis the kidney may be later on involved as a remote sequel.

2. *Pyelonephritis* has a grave outlook for the kidney itself and for life in some cases. Mild involvement of the kidney may be followed by damage so slight as to permit full function of the sound portion of the organ, but severe attacks usually mean loss of one kidney function more or less fully in the form of chronic pyelitis, chronic pyelonephritis, pyonephrosis or abscess and perinephritic abscess combined with the former conditions and, of course, with profound changes in the ureter, as stricture, kinks and infiltrations. When both kidneys are involved the outlook for life is dismal. The patients die by septic absorption, uremia, failure of the opposite kidney to compensate during the acute onset or by secondary infection sometimes after the first kidney has become destroyed or by the initial intense infection.

**Diagnosis of Ureteritis, Pyelitis and Pyelonephritis.**—Diathesis, low resistance and previous attacks of nephritis are usual in the history, often combined with acknowledged habitual or incidental errors in diet, drink, drugs, exposure and traumatism. In true gonococcal cases of ascending type facts are elicited concerning severe anterior urethritis rapidly invading the posterior urethra and bladder and then reaching the kidney either by direct ascent of the ureter or by indirect attack through the bloodstream or lymphstream. Complicated gonococcal urethritis especially of the abscess type in the prostate and seminal vesicles is more apt to present the infarct variety of renal involvement. Symptoms subjectively are the onset of profound infection with digestive disturbance, fever, perspiration, prostration and the feeling of being deeply sick. Discomfort increasing to varieties and degrees of pain in the renal zone, pollakiuria, dysuria, referred pains and the usual colic, temporary anuria and the like mark the local signs. Objectively, the patient is really sick with high fever and ranged pulse. Palpation usually demonstrates one or both kidneys enlarged in one or more particulars as to size, tenderness and consistency. If the ureter is draining these signs are less than when it is occluded. Tenderness and boggiess along the affected ureter are not uncommon. Cystoscopy offers recognition of an absolutely or relatively normal bladder, recipient of pyuria from one or both ureters showing, as a rule, profoundly altered mouths. Catheterization of the two ureters establishes their permeability and the degree of disease in one or both kidneys. Functional tests complete the picture and about as to x-ray findings is removed by the shadow catheters and silver salt solutions. Laboratory details cover the bacteriology of the pus recovered and the elements of destruction of the affected kidney, while treatment directed to the source of the infection indirectly aids its control. Exact anatomic diagnosis is often not reached until the kidney is under operation by nephrotomy or nephrectomy.

*Chronic ureteritis, pyelitis and pyelonephritis* are manifested with a history of acute urethritis followed by cystitis and ascending infection or of metastatic hematogenous invasion during severe complications

of the disease. Subjectively one notes low-grade inflammation with definite absorption if the ureter is not occluded so that drainage into the bladder is constant; but if it is occluded discomfort, pain, oliguria and anuria are not uncommon, whereas objectively fever and feverishness, obvious infection, sickness, prostration, the presence of a tender mass over the kidney zone increased by accumulation of pus decreased by its evacuation may be present. Cystoscopy and ureteral catheterization with separated urines are absolutely essential while the laboratory determines the kidney efficiency and the constituents of the specimens—physical, chemical, microscopic and bacteriological. During occlusion the unaffected side shows relatively normal urine. Treatment aids in the diagnosis through the fact that antiseptics and mild measures relieve less active cases while exposure of the kidney followed by drainage or removal supplies the anatomical diagnosis.

**Differential Diagnosis.**—Distinction is often required between other conditions causing enlargement of or pus accumulations in other abdominal organs and ureteritis, pyelitis and pyelonephritis. The latter term embraces more or less fully the older term pyonephrosis. Such conditions are on the left side, enlarged spleen and neoplasm of the stomach; on the right side, enlargement of the liver, inflammatory and calcareous distention and neoplasm of the gall-bladder; and on both sides, subphrenic and perinephritic abscess among infections and among neoplasms benign and malignant degenerations of the kidney, new growth of the colon or of the retroperitoneal tissue. Of this partial list all have no urinary signs discoverable by cystoscopy, ureteral catheterization and functional test except perinephritic abscess in some cases by outward extension from a localized infection of the kidney and except neoplasms of the kidney which often give pus and blood in the urine and changed function of the organ. In general, these three means of investigation with *x*-ray added are the chief means of differentiation.

*Enlarged spleen* is suggested by the history of leukemic tendency, malarial infection, or hepatic enlargement from any cause. The symptoms are usually slight when referred to the spleen itself but comprise weight, dragging and pain. The changes in the organ are recognized by its position, relation to the ribs, mobility, consistency and shape. Enlargement of the other lymph glands will further prove the diagnosis of leukemia. Palpation and percussion of the liver will discover any hypertrophy which is the basis of the splenic enlargement. Radiography is of great advantage in ruling out the kidney as the organ affected and finally, cystoscopy, separation of the urines and functional tests prove that the urinary system is not at all compromised. If the laboratory investigation of the blood shows that the process is not purulent and that malaria or leukemia may be present. The urine obtained from the bladder and by ureteral catheterization is normal. Treatment, usually medicinal, directed to the leukemia or malaria or the enlargement of the liver is the last detail of diagnosis.

*Neoplasm of the stomach* offers gastric indigestion as the chief general picture of the history. Chronic gastritis, hematemesis, acute recurrent attacks of indigestion and inanition are chief among the subjective symptoms. The tumor, if palpable, is objectively relatively mobile and in cases of profound involvement cachexia is the rule. The mass may be moved directly from the kidney area. Full urological investigation with the cystoscope, ureteral catheters, functional tests and laboratory analyses rule out the kidneys and ureters from consideration. Radiography is of great service with or without the ingestion of bismuth. In the laboratory test-meal observations must not be omitted and often present changes in the chemistry and digestive power of the gastric juice and special evidence from the quantity and quality of detritus and epithelia found in the lavage. Examination of the blood for secondary anemia and signs of cancer and the exclusion of proof of pus-processes should be done. Signs of anemia due to the cachexia of old cases are present. Treatment medicinally directed to the gastric disturbance is an element of proof, and surgically aimed at exploration or removal of the mass is the final detail of diagnosis even when the tumor cannot be felt easily through the abdominal wall.

*Enlargement of the liver*, more usually new growth than cirrhosis in differentiation from renal disease, is often difficult of recognition. The history of new growth is often barren of details except indefinite digestive disorders, discomfort, and irregular shooting pains. In cirrhosis, syphilis may be admitted and alcoholism with attendant digestive derangement apparent. The subjective symptoms are hepatic disorder, biliousness and jaundice which sooner or later sometimes occur with piles and other intestinal disorders through venous obstruction. Pain when it appears is apt to be constant and nagging and cachexia marked. Objectively, if the enlargement is general or extensive it changes the whole organ and pushes it downward, but if local its position and relation may be nearly normal. Radiography may show definite increase in the liver shadow at one or more points and the patient does not complain of any urinary disturbance or disorder. Urologic investigation is required because the element of pain, however, is in the general region of the kidney. The three standard steps of cystoscopy, ureteral catheterization and functional test should be carried out, and result negatively. In the laboratory analysis of the mixed urine in the bladder and of the separated specimens shows healthy kidneys and that of the blood is free of signs of pus production, but sooner or later shows the anemia of cancer and in cirrhosis often a positive Wassermann test. Treatment by exposure of the liver locates and measures the neoplasm and syphilitic treatment may benefit cirrhosis and thus the diagnosis be completed.

*Inflammation, calculus or neoplasm of the gall-bladder* much resembles the findings of the history just given for the liver itself. Inflammation and calculus are apt to give a rapid onset while neoplasm has a slower onset and then the invasion of any one of the three may be followed by

active and severe sufferings, in the subjective symptoms of deranged digestive function, both gastric and intestinal. Jaundice is frequent and anemia with emaciation not uncommon. Gall-stone colic is intense, characteristic and debilitating. Objectively, cachexia suggests cancer and a tumor or thickening in the region of the ninth rib points to the gall-bladder. X-ray often fails but may show the shadow of stones or neoplasm. The only element pointing to the kidney is the location of the pain and of the enlargement as the gall-bladder corresponds rather well with the upper border of the right kidney. There are, however, only negative findings on urological analysis of the case by cystoscopy, ureteral catheterization and functional test. Laboratory specimens of blood contain bile, and signs of anemia or neoplasm and all those of the urine are negative. Medicinal treatment is usually of little value in the diagnosis which is fully established by laparotomy and appropriate steps with the stones, inflammation or neoplasm.

*Subphrenic abscess and perinephritic abscess* are infections and may closely simulate in history the onset of infection of the kidney. Each has respectively an hepatic and a renal syndrome, either because the abscess arises directly from one in the liver or the kidney or because of the accumulation of pus in direct relation with these organs. As symptoms, subjectively there occur chills, fever, sweats, changes in pulse, prostration and confinement to bed. Pain is severe, throbbing and localized in the character typical of pus foci. Objectively, in general, depression of the liver as a whole suggests subphrenic accumulation of the pus while a mass in the loin, especially if without the form of the kidney or its consistency or with the prominence of the kidney upon its surface displaced to the front, suggests a perinephritic focus of the pus. Physical examination will, therefore, usually indicate the site of the difficulty, which in liver cases is cleared up by aspiration below the folds of the pleura and in renal cases by cystoscopy, ureteral catheterization and functional test. If these are negative, aspiration may be cautiously attempted but only by an expert familiar with kidney landmarks and the general anatomy of the parts. In the laboratory the blood count shows leukocytosis and the urine is negative unless abscess of the kidney has been antecedent. Treatment after pus has been proved present can be only surgical and aspiration is deficient and incision and drainage alone adequate.

*Neoplasm of the kidney* may have an insidious onset and be practically without special history, but usually there are prodromal signs such as discomfort and consciousness that something is wrong with the kidney. Symptoms, subjectively, may begin with the sudden increase of any or all of the indefinite feelings. Hematuria of the symptomless type may direct attention to the kidney, accompanied by pus and pain without there having been any antecedent focus of pus, pyogenic disease, chills, fever or prostration. Pain in the sense of severe agony is rare until the disease is far advanced. Sense of weight, blood, pus polyuria, oliguria and colic from blood or pus clots are typical. Sudden blood may be the first symptom and weakness and emaciation later



Examination shows in the early stages a normal-looking patient with cachexia advancing with the disease. The kidney may be slightly or much enlarged without or with tenderness, often hardened and if pus has appeared somewhat difficult to distinguish any other pyogenic disease of the kidney. The colon percusses in front of the tumor. Cystoscopy and ureteral catheterization in the early period may be negative unless made during the bleeding which at once indicates the diseased organ with possibly changed function. The x-ray may show enlargement on the affected side. In the laboratory separated urines may be normal or one redundant with blood and other changes, such as albumin, decreased urea, pus, epithelia, casts, fragments of tissue or ulcer and bacteria. Blood smears and count usually eliminate pus processes but indicate secondary anemia and cancer if the case is developed far. Surgical treatment as an exploratory or remedial operation by removal of the kidney settles the diagnosis.

*New growth of the colon* with its digestive disturbances, especially of the intestinal tract, in the history, proceeding to constipation, then obstipation with ribbon-like or scybalous stools, requires attention. The chief complaints are intestinal discomfort, augmenting to pain, indigestion with constipation just described, sometimes alternating with diarrhea, masked or free bleeding and later emaciation. Examination shows a mass in the colon over the kidney and without any bowel in front of it, often movable, slightly as the colon is, with in some cases dilatation proximal to it and atrophy distal to it. The colon may be followed in both directions from and continuous with the tumor. The x-ray with a bismuth meal will show the constriction by the tumor and the condition of the bowel each side of it and its relation with other organs. Cystoscopy, ureteral catheterization and functional tests are all negative. In the laboratory mixed urine taken from the bladder or collected by separation is negative. The stools contain fragments of mucous membrane, blood from the cancer and mucus from the colitis always present rather early. Blood smears have no leukocytosis as of pus in acute foci but show signs of anemia and cancer. Treatment by extraperitoneal or intraperitoneal exploration and removal settles the anatomical diagnosis, although clinical decision is certain without it.

*Retroperitoneal growths* have indefinite lumbar pains, discomfort and enlargement, in their history, as prominent factors and in their subjective symptoms urinary and intestinal signs are absent until the neoplasm causes displacement and pressure rather than obstruction. Likewise by pressure sometimes neuritis of the lumbar nerves causing referred pains and muscular spasm are seen. Objectively, the tumor may be shown independent of either kidney, the colon or other abdominal organs and present only in the loin or side. Cachexia appears in old cases. X-ray without the bismuth meal outlines the tumor and with the bismuth meal separates it from the colon and with collargol or other opaque substance in the ureter and pelvis distinguishes it from the kidney. The bladder is normal on cystoscopy and the ureters and kidneys on functional test. In the laboratory urinalysis

of bladder and separated urines is negative and investigation of stools negative for blood and tissue. The blood count shows no active pus processes and may develop the changes of anemia and cancer in advanced cases. Treatment by operation avails in the final anatomical proof by removal of the mass and later pathological investigation.

**Treatment of Gonococcal Acute and Chronic Ureteritis, Pyelitis and Pyelonephritis.**—Gonococcal acute and chronic ureteritis, pyelitis and pyelonephritis are in their significance indubitably major, clinically in the severity, prognostically for the patient and therapeutically often leading to important operations.

Prophylaxis is indirect in the proper care of anteroposterior urethritis which prevents extension into the bladder. Suitable measures in cystitis focalize the inflammation there from ascending the ureters. Prompt relief of pus foci as in the prostate, seminal vesicles and their complications prevents hematogenous and lymphogenous involvement of the kidneys followed by the bladder by descent after previous escape. Abortion is *nil*. Early symptoms of ascent from the bladder are indistinguishable from the symptoms of cystitis and the hematogenous and lymphogenous forms are so sudden that no diagnosis is possible permitting abortive measures.

Requisites for the management are given in the Chapter on General Principles of Treatment on page 483.

*Curative Treatment.*—In reaching these cases the underlying conditions must be understood. The physical measures in acute periods contraindicate massage but later it is a substitute for muscular exercise when generally applied and should not be locally employed on the kidney. This dictum does not include incidental massage of an infected kidney to bring down pus during a cystoscopic examination. No aggravation of symptoms must follow any massage.

The hydrotherapy, locally, stops all urethral treatment and similarly vesical irrigation, both in the acute stage but resumes them in the declining and terminal period. Cold with the ice-cap and heat with the electric pad or properly applied poultices or hot sitting baths all decongest and promote comfort. General hot packs and baths are indicated as eliminants in the acute periods when urine is deficient and as corrigents in incipient uremia. In the ambulant periods Turkish baths if well borne are of great value in relief of the kidney-tension and should be taken two or three times a week if possible.

The application of light except with the arc light in the specialist's office is of less value to kidney and ureteral conditions than to other more superficial complications. It acts as a decongestant and sedative in the acute period and may help in the resorption through actinic influence. In general, like hydrotherapy, it is much more convenient to apply and a very good alternate for modified influence.

The electrotherapy comprises diathermy or the direct d'Arsonval current with one plate over the kidney zone in front and the second plate over the kidney zone behind. The intensity is 200 to 500 milli-

amperes of current, the duration thirty minutes, the frequency is three times a week and the action is hyperemia of the organ in combat with the infection somewhat like the Bier treatment in arthritis and shows the results of increase tissue resistance and local metabolism. A series of twenty treatments is advisable with a rest of two weeks between during which heliotherapy is employed as adjuvant and corrigent.

The medicinal measures in the acute period all support against depreciation and prostration and are indicated by systemic administration as familiar stimulants, digestants, eliminants, diuretics and urinary antiseptics. In the chronic stage anemia and other results of deficient kidneys receive treatment.

The serumtherapy is practically useless in the acute lesions but in the late stages if the negative phase is carefully not produced in marked form there is response in active immunity in a few cases to autogenous or heterogeneous or mixed bacterins, notably Van Cott's. Small doses, slowly ascending always within tolerance and repeated every five to seven days, are the rule, as described in the section on this subject in Chapter IX on General Principles of Treatment, on page 483. The serum in inducing passive immunity may be disregarded in these lesions.

In the local treatment urethral lesions are left alone in the acute period exactly as in all the other complications so that no irrigations or injections are permissible. The bladder had best not be invaded, if possible, during the acme and should otherwise be managed like a cystitis, as described on page 173. The benefits of retrojection should be secured at each lavage. In the subacute and chronic periods, therefore, all the measures available in cystitis become possible and applications through the cystoscope to the bladder are not of least importance combined with lavage of the pelvis and ureter. The principles of such irrigations are the same as those defined for all mucosæ—gentleness in passing the instruments and mild solutions at first followed by slow ascent in strength to avoid traumatism and irritation. It is well to use small ureter catheters first for ease of the return flow without spasm or distention. Sterile water or other cleansing agent should be used first followed by nitrate of silver which is the best in from 1 in 1000 to 1 in 100 concentration. Argyrol 3 to 10 per cent., collargol 3 to 10 per cent. and protargol 0.5 to 1 per cent. are also available. The technic of this procedure is given in Chapter XIII on Cystoscopy, on page 734.

Antecedent urethritis may be treated through the cystourethroscope in the manner described under that subject on page 647.

The nonoperative surgical measures are defined by the occasional retention of urine due to reflex inhibition as catheterism with the single passage or the indwelling catheter according to indications to avoid frequent entrance into the bladder. The other nonoperative procedures, such as irrigations, instillations, retrojections and dilations obviously belong to the urethra and bladder, as already described for these sites.



The operative surgical measures devote themselves to conditions beyond ordinary measures. In the minor operations the posterior urethritis is treated by urethroscopy and the cystitis by cystoscopy, described on page 806, each antecedent to the ureteritis and nephritis and after the declining period of the latter two, they are also subsequent to them and require treatment usually to avoid relapse and new extension upward.

By catheterization of the ureters is made diagnosis of ureteral and kidney conditions, evacuation of accumulated exudate and cleansing and stimulation of the mucosa—all in the methods described under this subject in the Chapter on Cystoscopy on page 826.

Among the major operations are drainage of the kidney, nephrotomy and nephrectomy in the order of their severity, both as to cause and nature. Exposure of the kidney for each is the same so that it is best to describe the technic for nephrectomy first.

*Nephrectomy* may be done by several methods: (1) Lumbar, (2) paraperitoneal, (3) transperitoneal and (4) morcellation. In supuration of the kidney the lumbar route is preferred and will therefore alone engage our attention. The paraperitoneal method consists briefly in opening the loin rather anteriorly and in turning back toward the opposite side the entire peritoneum with its contents until the kidney is reached. The transperitoneal is the abdominal method and involves opening the peritoneal cavity, isolating its contents with pads and reaching the kidney through the parietal layer over it, which after vertical division is turned outward and inward for access to the kidney and its pedicle. Morcellation is removal of the kidney in small pieces either from within its fibrous or its fatty capsule according to circumstances.

The selection of case requires a kidney which is severely damaged and its function on urinalysis and catheterization of the ureters either profoundly altered or abolished. The instruments and supplies are assorted scalpels, various scissors with blunt points, long and short and straight and curved blades, assorted long forceps without and with teeth, hemostats and ligatures, abdominal retractors with narrow and wide and long and short blades, several pedicle clamps with curved and angle jaws, right and left and right-angle aneurysm needles or other ligature carriers, needle-holders with assorted needles including intestinal needles, sutures of catgut, silk and silkworm gut, cigarette drains and standard dressings. The preparation of the patient and field are standard and include a wide area from the hip to the nipple and two-thirds around the body and the anesthesia is generally preferably with gas and oxygen as the first choice and gas and ether as the second choice or local according to advanced methods of injection and infiltration. Braun-Shields<sup>1</sup> says: "Kappis recommends simple paravertebral conduction anesthesia without the concomitant circuminjection. For this purpose the eighth dorsal to the first

<sup>1</sup> Local Anesthesia: Its Scientific Basis and Practical Use, 1914, p. 322.

lumbar nerves must be blocked; for operations on the ureter, the second and third lumbar nerves must also be blocked." He also states that "since the development of this method almost all kidney operations are performed under local anesthesia at the Kiel clinic."

The posture provides the following details: Utmost extension of the iliocostal space; full freedom of respiration; absence of pressure or constriction by sharp edges; security against shifting or slipping of the body; protrusion of the kidney into the wound by pressure from in front. Various tables with kidney attachments and separate devices such as Edebohls's bag are recommended, with preference for the tables because they are secure against slipping and permit change of position by more or less elevation. The landmarks are the vertebral column in the middle line with the border of the erector spinæ muscle, the twelfth rib above and the crest of the ilium below setting off the iliocostal space.

The incisions are variously placed: (1) Vertical, parallel with the outer border of the quadratus lumborum muscle; (2) oblique, from about the center of the twelfth rib downward and outward to the anterior-superior spine of the ilium, ending midway between this prominence and the umbilicus; (3) transverse, passing just below the tips of the twelfth and eleventh ribs horizontally forward from the erector spinæ muscle; (4) rectangular or Koenig's incision combining the vertical with a more or less horizontal forward incision from its lower extremity just above the crest of the ilium; and (5) combined, in which any two of the foregoing incisions are variously united to gain space, usually the transverse (3) with one of the other forms. The vertical incision is one of the most common and passes through the skin, fat and fascia between the middle of the twelfth rib and the crest of the ilium in the superficial field, reaching above the latissimus dorsi fibers directed upward and outward toward the shoulder and below the oblique externus fibers running downward and forward toward Poupart's ligament as the first muscular layer. After severing these it exposes above and then divides the serratus posticus inferior fibers directed upward and outward between the spine and the rib, and reveals below, then cuts the obliquus internus fascicles directed upward and outward toward the middle line of the body as the second muscular layer. Along the mesial border of the incision lies the sheath of the erector spinæ which remains unopened, and across its lower portion is the ilioinguinal nerve which should be protected by retraction. This exposes the deep layer of the lumbar aponeurosis. Division, thereof, along the entire length of the skin incision enters the deep field upon the quadratus lumborum muscle either at the inner margin or bottom of the wound forms either retraction inward or separation of its fibers to the transversalis fascia and fat beneath it. Separation of these with the fingers or by blunt dissection frees the peritoneum which with the colon is retracted toward the abdomen and carefully padded and further separation reaches the kidney.

The oblique incision is preferred by the author because extension



downward gives access to the ureter. It begins at the midpoint of the twelfth rib and ends just above the anterior superior spine in correspondence with the direction of the obliquus externus fibers, for blunt separation and not sharp division along their course. The cut may be lengthened to and even across the sheath of the rectus abdominis for very wide exposure in the paraperitoneal approach of the ureter or downward toward the symphysis pubis for reasonable access to the bladder. In the iliocostal space the general planes passed duplicate those given for the vertical incision.

The resection of the twelfth rib is often practised subperiosteally in order to gain space, about two inches of the rib, often including its tip being removed and division of the costovertebral ligaments is a less radical step for the same purpose. The pleura often dips below the rib and must be spared.

The cautions of the incision are the ilioinguinal nerve, peritoneum, colon, pleura and the sheath of the erector spinæ. The iliohypogastric nerve is sensory and may be divided if encroaching on the upper part of the wound but the ilioinguinal is partly motor and must be spared in the lower portion. The peritoneum and pleura, if wounded, should be carefully closed with banked Lembert sutures and the bowel similarly managed, if damaged. Invasion of the sheath of the erector spinæ is of little importance except that it opens another plane of possible infection and should, therefore, be avoided by keeping lateral to its border.

The separation of the kidney is digital, if the fat is healthy and soft, and by blunt dissection if the fat is diseased and adherent and must reach complete exposure unless the fatty capsule is to be removed. Presenting parts are first approached and, therefore, in the anatomical terminology, the lower pole, posterior surface, outer border, anterior surface, upper pole, mesial border, hilum and pedicle in the order given are liberated.

The cautions of the separation are aberrant vessels in resistant strings of fat requiring division between double ligatures and adhesions about the pedicle denoting double mass ligatures or penetration with the aneurysm needle and ligature in sections. Either method is followed by terminal ligature of each vessel as it presents in the cut end of the pedicle.

The delivery of the kidney upon the loin is easy and safe provided the vessels are not too short and that the perinephritis has not been so dense as to fix the kidney pedicle and that the patient is not so fat as to materially increase the distance from the great vessels to the surface. The organ must reach the skin with little or no traction, otherwise shock is certain and tearing of large trunks probable with hemorrhage hardly equalled elsewhere in the body and at the bottom of a deep and inaccessible wound.

The isolation of the pedicle rests on the anatomical fact that the pelvis is most posterior and lowest of the structures at the hilum. Hence the finger hooked around the structures below the lower pole

will embrace the ureter, which may be easily separated with another finger or blunt scissors, while either the kidney is turned backward toward the skin and inward toward the spine or its lower pole elevated for slight tension on the ureter. Digital or blunt instrumental dissection of the ureter should be carried downward quite to the brim of the pelvis. The ureter may be found against the parietal peritoneum, as it is held out of the way toward the middle line of the body, through adhesions to the serosa and with the general direction over the outer border and anterior surface of the *psoas magnus* muscle. The tube should be liberated from the brim of the pelvis to the kidney and then the pelvis of the ureter is freed first posteriorly, then its lower and upper borders and finally its anterior surface if the fat is healthy, but if hardened with infection, dissection is stopped practically at the lower pole of the kidney. Thus the vessels are brought into view with the artery in the middle and the vein in front in typical cases but often the bifurcations are atypical. Division between double ligatures of the ureter as far down as possible is the next step with cauterization of both stumps with carbolic acid and alcohol, thermocautery or electrocautery. The distal stump is advisedly stitched to the subcutaneous fascia near the lower angle of the wound for ready reach in case of secondary remote trouble with it. The proximal stump may be used as a tractor on the kidney and a guide to the vessels of the pedicle with judgment and gentleness.

After isolation of the pedicle in degree according to pathologic conditions, a renal pedicle clamp is placed across it next to the kidney and closed tight enough to stop circulation but not to cut through the veins. Further separation of the vessels may be possible. A ligature is passed proximal to the clamp, that is, between the aorta and vena cava and the clamp, but not so close to the great vessels as to slip through pulsation and pressure or so near the clamp as to slip through too short a stump. When the ligature is seen to close the vessels fully, as tied, the kidney is cut free and removed and the mouth of each vessel gaping in the end of the stump is seized with artery clamp and ligated for safety.

The cautions of removal refer to the dissection and the ligation. As to cautions of dissection one notes that: (1) the pelvis should not be minutely freed at the pedicle amid adhesions but the ureter should be tied low down and (2) free extension of the incision downward and inward is required for full management of the ureter.

As to cautions of ligation one defines that: (1) the ureter is doubly ligated, divided and both stumps cauterized; (2) clamps are closed only to stop bleeding without risk of cutting or tearing through the veins of the pedicle; (3) vessels are ligated between the clamp and the body and not between the clamp and the kidney, that is, proximally and not distally; (4) vessels are ligated during relaxation and not during tension or traction; (5) adherent pedicles are best ligated twice in mass or twice in halves in mass if transfixion is possible rather than after dissection of individual vessels, which usually tears the veins;

(6) clamps may be left on pedicles too tough to be ligated and removed in four or five days; (7) division of the vessels is made away from the clamp for proper length of stump against slipping of the ligature; (8) all exposed mouths of vessels in the stump should be individually ligated.

The drainage to the stump of the ureter and pedicle and pocket of the upper pole is provided with cigarette drains reaching the surface at the lowest angle of the wound, after careful toilet of the cavity. Suture of the planes of fascia and muscle is carefully done down to the drains and the skin is closed with silkworm gut every inch or less. A very large dressing should be applied in layers and protected by a many-tail or ordinary abdominal binder, so as to permit frequent removal during the period of free oozing of pus, serum or blood.

*Aftertreatment.*—The immediate aftertreatment respects the wound and the other kidney. As to the wound the dressing should be inspected every ten minutes during the first hour and at longer intervals during the first day for secondary hemorrhage or undue oozing. The dressing should be changed down to the deepest layer in the later case and again watched at brief intervals in order to be sure that the oozing is checked. The drains are replaced as soon as loose and those from the pedicle are last disturbed. The stitches are cut out from the seventh to the tenth day and if clamps were left on the pedicle they are slightly loosened on the fourth day and removed on the fifth or sixth day.

As to the other kidney, the aim is to promote its increased function. The diet should, therefore, be antinephritic and salt-free until the organ is known to be fully competent. In the earlier convalescence the Murphy drip one hour on and one hour off or proctoclysis a pin at a time is a good stimulant. Hot packs in severe cases are essential and, if well borne, will often tide the patient over the dangers of acute uremia.

As to the antecedent urethritis and cystitis proper aftertreatment requires their cure along the lines described under each, otherwise either or both will remain as foci of relapse or reinfection. These lesions are therefore of great importance in the full restoration of the patient.

The remote aftercare continues drainage and dressing of the wound along strictly surgical lines so that in from four to eight weeks the cavity should be closed without sinus. Nursing, diet and medication are according to indications and frequent urinalysis. The remaining kidney is protected by warning the patient against any errors leading to congestion or other disturbance, such as excesses in diet, drink, exercise and exposure. After several months if the kidney is found to be secreting normal urine the ordinary conditions of life may be resumed.

*Cure* implies a healed wound without sinus or other sequel and normal kidney on the opposite side. Nature may be slow in supplying the second detail so that the remote aftercare is usually extremely

important. Pathologically, cure of the kidney by removal is impossible but of the less affected organ is the expected result and the relief from the danger in a destroyed and infected organ is obvious. Symptomatically, cure is restoration of the opposite kidney from signs of overwork, congestion and perhaps early inflammation or infection to full and normal function and bacteriologically the absence of organisms in the urinary system is in gonococcal complications entirely essential.

*Nephrotomy* is a much less severe operation than nephrectomy and in a certain sense exploratory in the selection of case of severe ureteropyelitis, pyelonephritis, calculus, abscess of the kidney or perinephric abscess. All preliminaries are the same as for nephrectomy, including preparation of the patient and field, incision, superficial and deep fields, isolation of the kidney and its delivery on the loin.

The examination of the kidney includes palpation, needling, fluoroscopy, control of hemorrhage and penetration. As to palpation, the delivered kidney is supported on the palmar surfaces of the fingers passed about its pedicle and then the opposite hand in regular order examines the ureter, pelvis, calyces and parenchyma, from upper to lower pole and from hilum to free border for irregularities of surface and consistency, induration and tension, fluctuation and calculus. The retained kidney in the depth of the wound may be felt in the same systematic but less thorough manner when it cannot be delivered.

As to needling or multiple puncture of the kidney for similar diagnosis it should be said that the method is no longer in favor except in verification of definite points detected by palpation. It is not reliable, rather unsafe and best omitted but does not include aspiration of suspected abscesses with a needle and syringe. It consists in stabbing the parenchyma one or two dozen times through and through with a needle, aiming to strike any pathological focus, especially stones.

As to fluoroscopy, much may be learned by having a good x-ray machine in the operating room and the portable hand screen available with which the kidney and pelvis delivered on the loin are inspected for infiltrations and stones.

As to control of hemorrhage, one recognizes prevention and relief. The prevention implies compression of the vessels to avoid the bleeding in a mobilized and delivered kidney. Digital or rubber guarded clamp compression is available, just to stop the circulation and always without traumatism of the vessels. The best clamps have rather thin jaws which meet first at the tips and gradually spring together, permitting the pedicle to be seized in the free interval and gradually compressed while the tips of the jaws steady the blades. The control requires tampon or suture. Tamponade of the wounded kidney is unreliable but often unavoidable when the organ is fixed in the wound and cannot otherwise be reached. Firm pressure with the outer dressing under adhesive plaster passing two-thirds around the body and frequent inspection for signs of failure of the packing must not be omitted. Suture is much more reliable and comprises two lines or one of mattress stitches always of plain, never of chromic gut, without

constriction, dimpling or lividity of the organ within the bight of the ligature.

As to penetration of the kidney for digital or instrumental exploration, a cut is made at the junction of the lower and middle third about a quarter inch posterior to the vertical midplane, is carried in the pelvis in depth and then enlarged to admit the little or the index finger, which should easily reach all the cavities of the pelvis. Splitting of the kidney from end to end may be performed for wide exposure for diagnosis or removal of pathological foci. Single abscesses are incised over their most prominent dependent point and stones removed by access on the same principle. Calculi in the pelvis may be removed by pyelotomy—division of the wall followed by removal of the stone and closed by a banked suture. Drainage of the kidney, as in pyelitis, hydronephrosis and pyonephrosis is accomplished by reduction of the mass of the distended organ through evacuation with the aspirating needle or trocar and cannula, then by penetration of the pelvis as just noted combined with gentle breaking down of all minor pockets into one major cavity and finally by suturing into the mouth of the kidney wound with a fine plain catgut, one or two velvet-eye, soft-rubber catheters lead from depths of the cavity through the lower part of the kidney to the skin. Patency of the ureter should be proved with ureteral catheters and other instruments before the operation is ended.

The suture of the kidney brings the halves of the divided organ and the lips of the wound together gently with two or one layer of mattress sutures always without constriction. The deep and superficial flaps are closed with layer sutures in the fascia and muscle planes down to the drains emerging at the lower part of the skin incision, closed with silkworm gut sutures.

The cautions of nephrotomy are: (1) Padding against infection of the planes and pockets of the wound during the operation; (2) drainage against retention in the recovery; (3) proof of patency of the ureter; (4) removal of offending stones, masses and the like; (5) control of hemorrhage with packing or suture; (6) drainage of the kidney, pelvis and cavity as needed; and (7) restoration of the kidney to its bed as nearly as possible in its normal relations to avoid kinks or other compression of the ureter.

*Aftertreatment.*—Immediate steps require regular cleansing of the tubes into the pelvis; irrigation of this cavity with sterile water, nitrofurantoin or silver 1 per cent. or argyrol 10 per cent.; renewal and shortening of the cigarette drain when loosening at the end of about a week; frequent renewal of dressings for cleanliness against pus and for prevention of hemorrhage during the first day. Nursing, diet and medication are those recognized for any type of inflammation of the kidney. Stimulation of the skin relieves the congestion of the kidneys should retention of urine, oliguria or anuria arise.

*Cure.* pathologically, so that the affected kidney is fully normal. It probably never occurs, but its physiology may be restored to normal by the surgical treatment of affected points in the removal of co



tions, either or both, followed by compensatory hypertrophy. This is symptomatic cure and is the expected result in most cases and in particular many ureterites and pyelites which have not involved the mucous membrane seriously and have not compromised the kidney beyond severe congestion and without true infection or inflammation. Bacteriologically in gonococcal disease relief from the presence of this organism is most important and one cannot speak of cure while it is present on smear and culture and while the positive complement fixation test persists.

### ACUTE RETENTION OF URINE.

**Definition.**—Acute retention of urine may be described as inability to evacuate the bladder, due to conditions within and about the urethra locally or within the central nervous system symptomatically leading to muscular spasm and paresis rather than to paralysis. As a complication of gonococcal acute urethritis, it is not to be confounded with the retention of stricture of the urethra, hypertrophy and neoplasm of the prostate and organic nervous disease.

**Etiology.**—The causes of acute retention as indicated in the definition are local, that is, urethral, as periurethral and centric or nervous. The urethral factors are edema and spasm of the sphincter. Within the urethra the edema of the mucosa may be inherent in the severity of infection or arise from irritation by instrumentation, alcoholism, food, sexual excess, exposure and exertion which may similarly cause spasm of the sphincter by their direct irritation. The spasm may also be of reflex spinal origin through the inhibition of such complications as gonococcal acute prostatitis and seminal vesiculitis. Outside the urethra by direct obstruction or by the same reflex influence, prostatitis, seminal vesiculitis and cowperitis may be elements. The centric or nervous factors are seen chiefly in the acute complications within the cerebrospinal axis, which go with severe absorptive septic types and are chiefly neuritis, meningitis and myelitis. They lead to temporary paresis or spasm, as a rule.

**Varieties.**—Retention of urine during a gonococcal infection in clinical classification is acute, occurring during an acute or declining urethritis; and relapsing, appearing during exacerbations of gonococcal chronic urethritis or during chronic hypertrophy of the prostate. The latter will be more fully discussed under these subjects. The retention of organic cerebrospinal disease does not concern this work.

**Symptoms.**—The patient shows in his subjective history sudden inability to void urine at all for a longer or shorter time or only in a few drops at each potent effort. Distention of the bladder causes excruciating agony. The objective signs are a bladder which is well above the symphysis pubis on palpation and percussion, protected by muscular rigidity and a urethra obstructed by any of the periurethral or endourethral causes. Centric nervous cases give their own peculiar

picture as discussed later in Chapter III under Centric Nervous Complications on page 239.

**Diagnosis.**—Acute retention of urine is considered only with its relation to urethritis and must have in its history the elements of obstruction, edema, muscular spasm, traumatism or excesses as to the urethra or the factors of pressure and spasm from prostatitis and vesiculitis as to periurethral conditions. The history of centric nervous disturbance in brain or cord followed by acute retention of urine is foreign to our subject. Obviously, if central nervous disease is suggested by the case in addition to the urethral infection, full neurological investigation for sensory, motor, reflex and trophic changes in the nerves and for signs of cerebral disease must be carried out. The chief complaints are inability to urinate at all or only slightly, with pain and the shock or prostration of overdistention. Objectively, the bladder palpates and percusses far above the symphysis and projects downward into the rectum. Urethral palpation often develops the site and nature of the obstruction. The laboratory must show infectious material within the urethra, most commonly gonococcal but rarely any of the other organisms causing urethritis and fully discussed under that subject. Relief of the obstruction, in the treatment, settles the source of the trouble and the diagnosis and suitable measures directed to the urethritis or its complications prevent relapse and likewise aid in the proof of the exact form of retention.

**Treatment.**—Gonococcal acute retention of urine is in its significance usually minor if reflex, as during the invasion of severe acute forms of posterior urethritis, prostatitis and seminal vesiculitis but is major if obstructive as is seen in stricture of the urethra and prostatic or other periurethral abscess.

Prophylaxis is indirect and applied to attention to the causes by avoiding the sources of edema of the urethra and irritation by instrumentation, alcoholism, improper food and drink, indirect and direct sexual excitement and physical exertion. Sedatives should quiet early reflex inhibition in posterior urethritis, prostatitis and seminal vesiculitis. Early diagnosis and treatment of pressure by extraurethral pus are preventives of major retention. Abortive measures relieve the edema by active hydrotherapy in hot penile, sitting and body baths, by reliable sedatives such as morphin and by evacuation of pus accumulations in any of the periurethral structures.

The reader will note the necessary particulars in Chapter IX on General Principles of Treatment on page 483.

**Curative Treatment.**—Physical measures are hardly available. Until relief of the retention massage is impossible, but then valuable for such antecedents as prostatitis. Hydrotherapy is active, especially hot urethral irrigations with adrenalin solutions 1 in 1000, rectal irrigation with hot normal salt solution through the double current tube or the prostatic cooler, and sitting baths hot until the skin is made very red. They all relieve the congestion and edema and frequently the retention so that the patient may evacuate his urine into

the sitting bath. Vesical irrigation is of value in cases dependent in cystitis. General baths eliminate and relieve the kidneys and Turkish baths are more efficient in cases dependent on kidney involvement. Hot packs are added for the same purpose. The heliotherapy requires a 500 C.P. therapeutic lamp very warm but not too hot moving steadily about over the field and applied up to intense redness of the skin but without pain or blister affecting the lower abdomen, lower perineum and back. Its results are the decongestion by profound hyperemia and the relief by diaphoresis.

The medicinal measures are sedative for the reflex nervous element by systemic administration including morphin and codein and their allies unless contraindicated by nephritis. Urinary diluents and neutralizers of recognized types soothe the entire urinary tract and eliminants and diuretics are available in kidney cases. Urinary antiseptics combat the infection and probably no combination is better for its urinary influence in all respects than the following formula whose elements are both adjuvants and corrigents of each other:

R—Hexamethylenamin . . . . .	7.5 grains (0.5 gramme)
Benzoate of soda . . . . .	7.5 grains (0.5 gramme)
Distilled water up to . . . . .	1 dram (4.0 c.c.)

Mix, make a solution and mark:

Take one teaspoonful every four hours, with a glass of water, or three times a day, two hours after eating, as improvement occurs.

By local administration the bladder is evacuated with the catheter, as subsequently stated, and much benefit results from the instillation of a few drops of nitrate of silver solution 1 per cent. or 2 per cent., which reduces the edema and congestion and often quickly controls the infection on which these rest. The quantity instilled must be only 2 or 3 drops otherwise damage and not benefit will ensue. All other local measures, such as irrigations, hand injections and instrumentations, are necessarily stopped until the tendency to retention has disappeared. The surgical measures, nonoperatively, include the use of a small velvet-eye soft rubber or a soft lisle-thread catheter very gently passed into the bladder after previous irrigation of the urethra with very hot normal salt solution containing adrenalin 1 in 1000, followed by irrigation of the bladder. In the nature of retention leaving the antiseptic fluid in the bladder for evacuation and retrojection of the urethra cannot be employed until the patient begins to urinate even imperfectly. Retention catheters are used for the more severe cases but always with hesitation and on the least sign of irritation with instant removal because their foreign body action makes the underlying condition worse. Irrigation of the bladder through such retention catheter is both possible and necessary. Operatively evacuation of pus accumulation in periurethral structures is preëminent, such as Cowper's glands, the prostate and sometimes the seminal vesicles. The operations are described under each heading. Cure of stricture of the urethra as a frequent underlying cause is imperative.

*Aftertreatment.*—The immediate aftertreatment is to soothe and quiet the bladder with urinary sedative diluents and antiseptics and also the nervousness of the patient reflexly and mentally and remotely is to alleviate the antecedent and consequent conditions both medical in the urethritis and cystitis and surgical in abscesses and stricture.

*Cure*, pathologically, must respect the underlying bases and so far as the retention is concerned should be complete but so far as damage of the urethra and its annexa is concerned may be very incomplete, as already demonstrated under the pathology of each lesion. Symptomatically relief of the retention is absolute either through catheterism or operation followed by systemic and local medication for the infection whose bacteriologic destruction is essential for cure.

## CHAPTER III.

### COMPLICATIONS AND SEQUELS OF ACUTE URETHRITIS. (Continued.)

#### COMPLICATIONS OF POSTERIOR GONOCOCCAL ACUTE URETHRITIS.—(Continued.)

##### B. EXTRAGENITAL OR SYSTEMIC GROUP.

**Clinical Importance.**—The gonococcus with its toxins may invade all systems of the body with complications which are the constitutional, systemic or extraurogenital manifestations. These complications will be discussed under the name of the system involved, as in the following subdivisions.

**Varieties.**—Cutaneous, digestive, circulatory, respiratory, central nervous, special sensory and locomotory complications are seen, each respecting its own system.

##### 1. *Cutaneous Complications.*

**Occurrence.**—The skin is not often affected but somewhat more in males than females and usually in the severe persistent gonococcal infections during other complications with absorption and toxemia. The occurrence of drug rashes during such cases makes it important to eliminate these as the possible lesions. The end of the first month is the common date of appearance. Their relation to the gonococcus and the toxins must be elucidated. Their clinical importance is relatively little.

**Varieties.**—Penile cutaneous folliculitis, condylomata acuminata, erythema, purpura and keratoses are most often seen. The first two are the most common and important. Their significance marks most of them as immaterial, especially folliculitis, erythema, purpura and keratoses on account of their rarity and occasional difficulty of identification with the gonococcal involvement; but condylomata acuminata are important.

**General Diagnosis.**—The reader is referred to books on diseases of the skin because more than outlines in this work would be redundant. A cutaneous complication during a gonococcal urethritis or its complications must be more than a coincidence. There must be absorption and circulation in the blood of the gonococci or their toxins in order to link the manifestations in the skin with the infection.

**Treatment.**—The lesions are cured along dermatological principles in soothing applications during acute irritation followed by stimula-

tion during indolent and chronic stages—combined, of course, with relief from the principal focus of absorption. Full details are referred to works on Dermatology.

### CONDYLOMATA ACUMINATA.

**Synonyms.**—Cantrell and Stout<sup>1</sup> give the following list: Pointed wart; moist wart; fig wart; cauliflower excrescence; verruca elevata; venereal wart; Ger. Spitzencondylom, Spitzenwarze; Fr. Végétations dermiques.



FIG. 53.—*Condylomata acuminata*, confluent form. Extensive *condylomata acuminata* of gonococcal origin filling the entire corona and preputial fold extending far forward on the glans on the right side as far as the frenum. Preputial excoriations were present on the left side but do not show in the photograph. (Author's case.)

**Definition.**—These are warts or true papillomata usually of venereal, not infrequently of nonvenereal origin, affecting the modified skin commonly over the glans and within the foreskin of the male, less commonly the cutaneous sheath of the penis, and over the external and internal labia and even the thighs of the female. The nonvenereal origin of these warts is important, otherwise unjust suspicion will be lodged against the innocent. Extragenital situations for these papillomata are the anus, axillæ, umbilicus and interdigital folds of the toes.

<sup>1</sup> An American Text-book of Genito-urinary Diseases, Syphilis and Diseases of the Skin. Bangs and Hardaway: 1899, p. 956.

**Etiology.**—Tendency to warts is definitely known and is a predisposing cause of the lesions under discussion. It is well, therefore, to look for other papillomata, on the hands, for example, especially when the case may be nonvenereal. Another predisposing factor is retention, accumulation and irritation of the smegma, thus repeating the conditions of apposition, excoriation, moisture, warmth and retention of perspiration in the extragenital forms. Added to these elements in venereal cases is the gonococcal infection with its penetrating, proliferating influence and in the nonvenereal cases, the microorganisms of the skin. That warts may be infectious is suggested by the case of Payne, quoted by Cantrell and Stout,<sup>1</sup> who after having removed a wart with his nail had one develop beneath the same nail.



FIG. 54.—Intraurethral warts. The mass entirely filled the meatus, causing a high degree of obstruction. They did not extend far up the canal so that removal with scissors was easy. (Author's case.)

**Pathology.**—As in all other warts, the essence of the process is proliferation of the papillary layer of the corium and thickening and differentiation of the epidermis with increase of connective tissue and vascularity. The cells of the rete are highly developed while the horny layer is scantily changed. Without treatment the warts are permanent lesions, and increase in size and number to remarkable extent. After removal no material scars persist. The associated lesions are regularly the gonococcal urethritis in acute, declining or chronic

<sup>1</sup> Loc. cit.



stage and the balanoposthitis which both causes and is produced by the warts. Occasionally these lesions are found within the meatus as well as in the situations noted under definition.

**Symptoms.**—The warts themselves by their actual presence and discharge in retractible foreskins are the only subjective symptoms, but in irretractible foreskins the irritation of the discharge from the chronic relapsing balanoposthitis is the chief complaint. The objective signs are in the loose foreskins under the eye or in the tight foreskins through a urethroscopic tube the papillomata themselves, which are like the cock's comb or cauliflower, usually pedunculated but less commonly sessile, vascular, from pinhead to lima-bean size, with a yellowish foul discharge or slimy crust. Subpreputial irrigation must be done in tight foreskins before a full examination can be made. The termination of these warts is indefinite persistence with relapsing balanoposthitis unless removed by treatment and their clinical significance is that the sodden condition of the parts which they induce is a direct avenue for syphilitic infection.

**Diagnosis.**—Common warts on the finger during childhood, eczematous and nonresistant conditions of the skin are frequent admissions in the history proving a tendency of the patient to papillary hypertrophy, to which is added the irritation of the gonococcal pus especially in folds of the skin of the prepuce in the male and the vulva in the female. Subjective symptoms are the flow or drop of pus from the urethra or vulva, furnishing the infection of the foreskin in man or pudendum in woman, followed by the gradual or rapid development of the warts in scattered, confluent or general distribution. Objective examination verifies the presence of the warts and the causative pus and determines their features as similar to a cock's comb, sessile or pedunculated and foully odoriferous and accompanied by the chronic drop and excoriating balanoposthitis or vulvitis. In the laboratory by smear or culture the infectiousness of the pus is proved as often due to the gonococcus alone and equally often to other organisms commonly found in the skin, associated with the gonococcus or independent of it. Section of a wart determines its benign character, while treatment is easy removal with caustic, knife or electric spark leaving behind no infiltrated base, thus proving its simple verrucous nature. Relief of the urethritis, balanoposthitis or vulvitis prevents relapse and again shows the lesion to be noncancerous.

**Differential Diagnosis** is concerned with syphilitic condyloma, including the moist papules of the secondary stage of syphilis, and malignant neoplasm.

*Condyloma latum* differs from *acuminatum* in always being associated with syphilis in one of its periods, usually the secondary, less commonly the tertiary stage. A careful history, therefore, elicits the fact of secondary or tertiary syphilis with the development of the condyloma or positive blood tests may be admitted with the chief complaint of a painless, moist sore under the foreskin or within the folds of the vulva with thin watery or blood-stained discharge and without any

other sensation except occasional ardor urinæ if urine touches one. Examination shows a broad, sessile, fissured exuberant growth never pedunculated in its attachment, with a serous, serosanguinolent or seropurulent discharge from which the *Treponema pallidum* may commonly be recovered. Characteristic cord-like lymphatic trunks and bean-like or shot-like lymphatic glands are always present. The laboratory determines the organism of syphilis in the discharge and in the tissue whose sections exclude malignant neoplasm. Treatment with mercurials, locally and internally, combined with the iodides or with the newer arsenical compounds is of immediate and corroborative effect and diagnostic proof.

*Neoplasm differs from condyloma acuminatum* in the age of the patient, through its history and in its onset under entirely different circumstances from those of infection. Cardinal symptoms describe a growth under the foreskin or within the folds of the vulva of an ulcerous, painful, infiltrating mass often accompanied early with involvement of the lymphvessels and glands. All the symptoms of chronic phimosis and chronic balanoposthitis are common antecedents. Examination on exposure of the growth reveals the infiltration, raised, hardened edges and bleeding surface of an epithelioma with hardened lymphtrunks and glands connected with it. The laboratory rules out infection with gonococci or the *Treponema pallidum* and in the section of tissue develops the neoplastic character, while all measures of treatment along the line of stimulation and cauterization fail to heal. Excision of the penis or a wide portion of the vulva along with the glands affected finishes the diagnosis by submitting the specimen to the laboratory.

The following case report of condylomata acuminata in an infant of remarkable degree is given by R. R. Smith.<sup>1</sup> No gonococci were demonstrated in the discharge.

It is seldom that so luxuriant a growth of condylomata is seen as the following case:

B. S., infant, aged nineteen months. Mother states that neither parent has had syphilis to her knowledge, but she had had gonorrhea nine months before the child was born, but without discharge at the time of birth. Child always well except for occasional diarrhea and without discharge or irritation about the genitals within mother's observation. Apparently within three months the entire growth as presented in the photograph developed, beginning on one labium. Fair nourishment, paleness, normal teeth and no skin lesions or scars of lesions were noticed on examination. The growth about the vulva is demonstrated by the illustration. The growth was removed surgically and the diagnosis of condyloma acuminatum was made by a pathologist. No gonococci were discovered.

**Treatment.**—Both prophylaxis and abortion apply in all their general principles.

<sup>1</sup> Am. Gynec., 1903, II, iii, 515.

*Curative Treatment.*—Usually all relief fails unless the acute gonococcal chronic urethritis is relieved, because removal of the warts will be followed by relapse unless the irritation of the discharge is absent.



FIG. 55.—Condyloma acuminatum in a child, aged nineteen months (Case of Dr. R. R. Smith.)

Curative measures have the following details and are all important. The management is the same as that in any other gonococcal disease and physical methods come to the fore with fulguritic warts with the high frequency current of Oudin, representing therapy in this field and fulfilling special service in the condyloma of the meatus and the urethra. Its application is simple with an ordinary high-frequency machine developing the current of 100,000 volts. The spark gap is from one-twelfth inch to one-eighth inch and the switch is usually half open. Local anesthesia may be applied but is not absolutely necessary. The current is applied until blanching or mild blackening occurs which is followed in a few days by the sloughing of the lesions. As a rule, a few are treated at each sitting until removed.

Medicinal measures consist in drying powders applied to the warts after this or other operation and occasionally to the warts themselves.

ey are few and scattered. They keep the base of the wound clean and prevent moisture from which these lesions proceed. A serviceable powder contains:

**R**—Calomel,  
Powdered alum,  
Bismuth subnitrate, of each . . . . . 0.5 drams (2.0 grammes)

**Mix**, make a powder and mark:

**External application** as directed.

**Small condylomata acuminata** may be removed by painting them with the following solution:

**R**—Salicylic acid . . . . . 0.5 drams (2.0 grammes)  
Glacial acetic acid enough to make a thin paste.

**Mix**, make a thin paste and mark:

**Apply** to the warts as directed until the surface is white. The surgeon and not the patient should carry out these applications.

The wart may be surrounded by a thin layer of white vaseline to protect its annexa and then the paste is applied rather liberally but without flooding and with the crystals of salicylic acid worked into the surface. Excess of acetic acid is removed with slips of blotting paper and then the application dries in the air and a small dressing protects the lesion, which will drop off in seven days or less. Several warts may be so treated at a time until all are removed with the one caution that the normal surfaces must not be attacked by the solution and that none must be allowed to reach the urethra. Apposed surfaces are kept apart by cotton loosely packed in.

**Surgical measures** deal at once with underlying phimosis and paraphimosis at the same time that the warts are clipped off. Marked lesions are always best removed under local or general anesthesia with forceps and scissors, including their bases, followed by gentle stimulation with 10 per cent. silver nitrate solution to still bleeding and prevent infection. The little wound is sutured if possible, and a healing powder applied. Warts of the skin are apt to be hard vegetations, easy of removal with closure of the base, while warts of the mucosa and modified skin are a little less easy of suture if their bases are extensive. Warts of the meatus may be clipped off with care not to injure the lips and with attention to healing to prevent stenosis; but like these growths farther in the canal the high-frequency current of Oudin is preferred to scissors. Warts about the anus and within the rectum are dealt with in exactly the same manner with incisions converging toward the anus in general correspondence with its normal folds. Through the proctoscope growths higher up may be fulgurated.

**Aftertreatment.**—Surgical dressings for cleanliness and primary union are required. The catgut stitches are absorbed. Secondary union is usually without deep scar.

**Cure** pathologically and symptomatically involves removal of the wart with its base, bacterial relief from infection and ablation of offending foreskin or other underlying anatomical cause, and these lesions are regarded as annoying but not grave.

## 2. Digestive Complications.

**Occurrence.**—When compared with gonococcal arthritis, the digestive manifestations are rare but are much more common than the cutaneous lesions.

**Varieties.**—Acute, subacute and chronic as to course are the chief clinical forms which are again subdivided as to site into buccal, anal, rectal and rectoanal. These are rather common, but esophageal, gastric, intestinal and colonic are without record in literature. Peritonitis is seen occasionally in males but frequently in females.

**Significance.**—Stomatitis and proctitis usually occur by direct transference of pus and are both obstinate and intractable and peritonitis is a severe invalidating and not uncommonly fatal condition. The clinical importance of these complications is great and of special concern for transmission of the disease to the innocent.

**Etiology.**—Invasion by the gonococcus is regularly the exciting cause, engrafted on absence of resistance in the body at large, or locally through some antecedent disease. Septicemic gonococcal urethrites are apt to have digestive complications.

**Diagnosis.**—The proof is of importance and is limited by difficulties of culture of the gonococcus, both alone or associated with other organisms. The gonococcus dies easily in unfavorable pabulum and surroundings and is probably destroyed by the various digestive secretions.

**Treatment.**—Exposed surfaces are freed of the infecting gonococcus and restored to as nearly normal as possible. Special surgical measures are required in proctitis and peritonitis.

## GONOCOCCAL STOMATITIS.

**Occurrence.**—Bacteriologically proved stomatitis is rare, especially in comparison with widespread sexual perversion. Prostitution determines a greater frequency among females than males, and ophthalmia causes it among children more than adults.

**Etiology.**—The gonococcus is present either by direct contact or by indirect deposit during bacteriemia.

**Pathology.**—The lesions are much the same as in other squamous epithelial mucosæ—hypersecretion, desquamation and suppuration.

**Symptoms.**—The stages of invasion, establishment and termination designated by the three pathologic processes just named are the same as elsewhere in the body.

**Diagnosis.**—The gonococcus must be detected by smear and culture and in septic cases the gonococcal complement fixation test is required.

**Differential Diagnosis.**—Determination of the cause distinguishes gonococcal stomatitis from simple acute and chronic inflammations, scarlet fever, measles and typhoid fever, diabetes, syphilis, scorbutus and metallic poisoning. Consultation with a dentist is always advisable.



**Treatment.**—Prophylaxis is of the eyes and nose. Local antiseptics to destroy the infection followed by astringent and healing lotions and proper care of the gums and teeth by a dentist are sufficient. In septic cases treatment of the primary focus is essential.

### GONOCOCCAL ACUTE PROCTITIS.

**Occurrence.**—When compared with several other complications of gonococcal acute urethritis, rectitis is not often seen but it is more common than stomatitis. Among European authorities, Jullien<sup>1</sup> believes that it is present in nearly 5 per cent. of all cases, which is an estimate far in excess of experience in America. In the Genitourinary Clinic of the House of Relief in New York City, for seven or eight years under the charge of the writer, with an average weekly attendance of about 150 cases, very few examples of it indeed were encountered. Taylor<sup>2</sup> says: "This affection is more or less frequently observed in countries in which sodomy is practised and it sometimes occurs in America." Full bacteriological proof is necessary comprising the three general steps of smear, culture and complement fixation in order to establish diagnosis. It is found more often in female than male adults, owing to the incidence of prostitution upon the former sex, on the other hand, however, so-called "male prostitutes" almost invariably have it, likewise boys who have been the victims of homosexual perversions.

**Varieties.**—Acute, subacute and chronic forms as to clinical course are recognized and as to site anal, anorectal and rectal, localized and generalized. The tendency of the disease to become chronic renders the mergence of the three clinical forms into one more convenient for description. Primary cases due to artifacts and secondary cases following other infections are seen. The rapid ascension from the anus into the rectum likewise renders clinical subdistinction unnecessary. In fact, the anal condition is prominent only in virtue of severe lesions above this muscle.

**Etiology.**—Penetration of the gonococcus into the rectum by continuity from the anus or by accident from instruments or fingers or by sexual perversion is regularly the exciting cause. Thus the entrance of the organism is either direct or indirect. As to indirect access, the predisposing factor in females is gravitation of the pus from the vulva and vagina upon the perineum and the anal region in the recumbent position, and its pocketing between the nates and the funnel-like form of the anus. The frequency of gonococcal infection in women without anorectal complications renders this cause unimportant and almost inert. Penetration within the sphincter ani muscle is also rendered difficult by tonic action which results exactly as does the similar state of the sphincter vesicæ in preventing progress of the gonococcus into the bladder. Growth of the gonococcus upon the anus is also

<sup>1</sup> *Rev. int. de méd. et de chir.*, 1905, xvi, 109.

<sup>2</sup> *Genito-urinary and Venereal Diseases*, 3d edition, p. 95.

hindered by the squamous epithelium there, which is poor soil. It is probable, therefore, that some cause is always present planting the organism above the limits of the muscle.

As to direct access, on which depend true primary cases, instrumental infection of the rectum with douche nozzles previously used for the vagina and then for rectal enemata is common. The writer had a patient who vigorously washed his genitals clean of gonococcal pus with a sponge and employed the same sponge at the same sittings to bathe his anus, with the result of gonococcal anoproctitis. The most common direct cause is sodomy, intercourse through the rectum or coitus per anum. Less usual is infection of the rectum from sinuses entering it from extensive gonococcal abscesses of the prostate and Cowper's glands.

Norris<sup>1</sup> notes "three cases resulting from the rupture of a pyosalpinx into the rectum."

**Pathology.**—The lesions of proctitis must largely be inferred from the behavior of the gonococcus in all other mucous membranes. The essence of the process is infection and penetration of the gonococcus into the mucosa, followed by temporary lesions in acute cases, such as congestion, edema, proliferation, infiltration, purulence and hemorrhage. Tendency to chronic thickenings in older cases are seen as permanent lesions exactly as in the urethra, so that the wall of the bowel loses its elasticity and even becomes narrowed. Likewise proliferation of the mucosa into condylomata acuminata is common. Associated lesions in the ischiorectal fossæ such as abscesses are seen which proceed from associated organisms like the *Bacillus coli communis* and in the wall of the rectum as fibrous deposits of semicartilaginous density, and if a sinus from a periurethral or periuterine complication has preceded the rectal involvement its features will be obvious. The involvement is usually confined to the terminal four inches but the whole rectum may suffer.

**Symptoms.**—The periods of invasion, establishment and termination with subjective and objective findings may be distinguished. Compared with other gonococcal infections the subjective invasion is relatively little; Luys<sup>2</sup> for example, says: "As a rule, anorectal gonorrhea is characterized by a complete absence of subjective symptoms." This can be only relatively true and the symptoms must depend on the severity of the inflammation and the comparatively less irritability of the rectum than of the urinary organs.

On the other hand, among older writers, Taylor<sup>3</sup> and among more recent authors Norris<sup>4</sup> describe marked and positive symptoms of the disease corresponding with the writer's experience.

Heat and discomfort are first seen, which, in the subjective establishment become marked and are followed by pain, irritation, discharge and functional disorder. The pain is due to the congestion, excoriation, ulcerations and fissures and the stimulation of the bowel to empty

<sup>1</sup> Gonorrhea in Women, 1913, p. 396.

<sup>2</sup> Loc. cit.

<sup>3</sup> Text-book on Gonorrhea, 1913, p. 233.

<sup>4</sup> Loc. cit.



self, which may be accompanied by all the irritation of general proctitis. The discharge is at first a serous moisture not greatly apparent upon the anus but rather accompanying the stools, and later becomes purulent and even bloody. Severe anal involvement is followed by folliculitis, minute ulcers and even fissures with their spasm and tenesmus. The early irritation of defecation becomes the agony of proctitis with its diarrhea containing pus and sometimes blood. Eczematous involvement of the anus, perineum, thighs and buttocks by secondary infection of the skin is complained of.

The objective symptoms are in suspects of sodomy a funnel-form anus through the unnatural practice and its force. The signs of inflammation may be comparatively little or marked, so that frequently proctoscopy and digital exploration are required for diagnosis. Such procedures the acute and severe stage forbids, but with subsidence of suffering they may and should be carried out. If the anus is involved it is reddened, edematous, the site of folliculitis, ulcers and fissures and surrounded by a zone of eczema extending to the perineum, intergluteal fold, buttocks and thighs, all bathed in a seropurulent or purulent, irritating discharge. The sphincter may be relaxed and moderate prolapse present. Venereal warts similar to those in genital gonococcal infection are common. All these conditions are repeated within the rectum itself. Jullien<sup>1</sup> gives three cardinal symptoms: the condyloma, the drop and the fissure. The condyloma acuminatum is pathognomonic when about and within the anus and rectum. It is delicate, friable, vascular, fimbriated and pedunculated or glossy and sessile and usually covered with thin, slimy pus. A case in the author's practice had the warts of various size and form distributed numerous and universally over the lower portion of the bowel for at least five or six inches and accompanied by the characteristic mucopurulent discharge and perianal dermatitis. To such conditions the term proliferative proctitis or proliferating rectitis has been applied.

The discharge or drop is gonococcus-laden and resembles the "morning drop" of chronic urethritis in being invisible until eversion of or pressure on the anus brings it to the front exactly as stripping the urethra in either women or men discovers the droplet of pus. In females pressure upon the anus from within the vagina is efficient. The drop is sometimes from a chronic folliculitis of the anal verge. The fissure is single or multiple and if the former is commonly posteriorly or under cover of a condyloma.

The termination follows a slow course of doubtful duration, excepting in very mild cases, due to the gonococcus, its penetrating power and possibly the natural local uncleanness. The mild cases reach a cure without sequels or complications in about the same period as a urethritis, namely, one or two months. The severe and general cases, however, come chronic and have sequels. Chronic infiltration and contracture are not uncommon. The bowel thus narrowed causes obstruction of

<sup>1</sup> Rev. internat. de méd. et de chirurgie, 1905, xvi, 109.

function, then chronic inflammation of the rectum alone at first, later of the intestine above it with digestive disorder and malnutrition.

**Complications.**—A common terminal complication is a slimy about the anus and its annexa, with sodden eczematous skin and tendency to inelasticity and stricture above. Brunswic-le-Bihan<sup>1</sup> recognizes three complications: acute and chronic perirectitis and stricture. Acute perirectitis or periproctitis is ischiorectal abscess containing rectal and intestinal organisms, notably the *Bacillus coli communis* entered by lesions of the wall caused by the gonococcus which is ordinarily not found in the pus or the walls of the abscess due to vulnerability of the organism, and its difficulties of growth, especially in the presence of such abundant other flora. Chronic perirectitis or periproctitis is really an infiltration of the perirectal tissues in semicartilaginous density with inelasticity and resistance as a belt strip, palpable to the finger and visible to the eye by its bulging and inertia. Symptoms of obstipation, pressure and weight of foreign substance and constipation, with pain and tenesmus due to the mucoproctitis associated with the lesion, are common. Gonococcal stricture of the rectum, as in the urethra, follows more or less deep destruction of the mucosa with ulcers, scars, general thickening, condylomata and widespread cicatrization. This process is within the rectal wall while that of chronic perirectitis involves the tissue outside it alone, or wall in addition. Both have much the same symptoms as just described on page 211.

Cases in literature of importance have all been published since the development of bacteriology, and therefore rest on absolute proof. The fullest historical review of gonococcal proctitis is given by Mermitt<sup>2</sup>. Tuttle<sup>3</sup> gives full bacteriologic proof of gonococci in the pus of the three patients as does also Griffon<sup>4</sup> in one patient. Hartmann<sup>5</sup> demonstrated gonococci in an ulcer of the anus. These positive findings in the cases of Tuttle, Griffon and Hartmann render them acceptable. Without full bacteriologic proof in smear and culture earlier case reports which omit such proof must be disregarded or discounted. Butcher<sup>6</sup> seems to have been the first authority to have established the identity of the gonococcus in the rectum and is so credited by Luys in *Text-book on Gonorrhea*.

**Diagnosis.**—The clinical admission or denial of sodomy in the history or of other source of contamination, sudden, severe onset, short period of intense symptoms followed by subacute or chronic tendency to relapse, condylomata or antecedent or accompanying genital gonococcal infection all tend to establish the diagnosis. The subjective symptoms during the acute period rectal pain, burning, irritation, frequent s

<sup>1</sup> Reported by Fournier: Bull. de l'Acad. de méd., 1907, lvii, 501.

<sup>2</sup> Gaz. des hôp., 1896, lxix, 531, 559. <sup>3</sup> New York Med. Jour., 1892, lv, 379.

<sup>4</sup> Presse méd., 1897, p. 71.

<sup>5</sup> Ann. de gynéc. et d'obstet., 1895, xli.

<sup>6</sup> Der Mikro-Organismus der gonorrhoeischen Schleimhaut-Erkrankungen, Wiesbaden, 1885, p. 49, and Arch. f. Gynäk., 1884, xxiii, 339.

diarrheal evacuation, mucopurulent and purulent discharge and occasionally bleeding. In the subacute stage these subside in degree but the follicular proctitis which usually supervenes may cause much discomfort and the chronic warty growths, fissure or follicular abscess and pus about the anus are complaints in the chronic stage. The objective symptoms are cardinal and include (1) the condylomata acuminata about and on the anal muscle and in the rectum, (2) the drop of stringy pus appearing under eversion or other pressure upon the anal muscle and (3) the fissure representing an infected follicle with abscess, sinus or ulcer and chronic drop of pus as the final result. The "funnel anus" with perianal eczema marks the pervert. Proctoscopy during the acute stage is not as a rule desirable but will reveal all the signs of severe inflammation, redness, edema, exfoliation, pus containing the gonococcus. Folliculitis in the subacute and chronic periods is characterized by inflamed and occluded or discharging follicles, infiltration, adherent strings and scabs of pus leaving a raw surface and frequently containing the gonococcus. The chronic period shows one or more follicles degenerated into sinus, ulcer or fissure and condylomata acuminata above the anus as well as on and external to it. These may extend several inches up the bowel and be extremely numerous—one case of the author showing several dozen of them. The laboratory findings are very important. The fact that the *Micrococcus catarrhalis* is gram-negative in its early periods and gram-positive in its later developments and closely resembles the gonococcus, makes careful bacteriology absolutely essential, combined with the use of the proctoscope for the distinction of objective symptoms. Often an active folliculitis will be found within the rectum or at the anus, whose pus when carefully secured will be free from other organisms than the gonococcus and settle the question. Smear, culture and complement fixation test make up the chain of evidence. Treatment is of no direct aid in the diagnosis with the exception that removal of the adherent scab and strings of pus furnish good specimens for the laboratory as does likewise evacuation of follicles. Antigonococcal antiseptics are also of suggestive value.

On this general subject Lynch<sup>1</sup> says: "In gonorrheal proctitis the anus has a rather typical appearance. Where the disease is acquired innocently, especially from massage of the prostate, the sphincter is spasmodically contracted and the mucocutaneous membrane is red; but after the disease has existed for some days, the skin becomes macerated, and is covered by a mucopurulent discharge. In the case of sexual pervers, the skin around the anus is thrown into edematous folds. It has a cyanotic or bluish-red appearance, and is covered by mucus mixed with pus. In some cases the mucous membrane is prolapsed, and it is with difficulty that the speculum can be passed very high. Here and there we see flakes of mucus and pus resembling those of severe peritonitis. The flakes are adherent to the mucous membrane,

<sup>1</sup> *Diseases of the Rectum and Colon*, 1914, p. 278.

and when removed leave a raw, bleeding surface. The mucous membrane in all cases bleeds very easily."

**Differential Diagnosis** is concerned chiefly with catarrhal proctitis and syphilis and chancroids of the anus.

*Catarrhal differs from gonococcal proctitis* in the absence of any history of antecedent infection or of perversion; in the much less intense subjective symptoms and in objective symptoms of having mucus and mucopus rather than pus as the discharge; in the freedom from the strings and scabs of pus leaving bleeding surfaces when removed and like the free pus containing gonococci; in the failure of laboratory findings to detect the specific organism or the complement fixation test and in the prompt response to simple treatment of the catarrh.

*Syphilitic differs from gonococcal proctitis* in the absence of any gonococcal findings whatsoever in the history and in the presence of abundant signs of syphilis elsewhere in the body and in the blood as a Wassermann test. It may appear about the anus as moist papules, condylomata lata and gumma each having its own features. The moist papules resemble the mucus patches of the mouth in being slightly raised above the surface, surrounded with indolent inflammation and infiltration and in having a moist "varnished" surface, serous discharge and the *Treponema pallidum* abundant. This process does not extend materially into the rectum proper, and bears little resemblance to gonococcal warts. The condylomata lata might be regarded as exaggerations of the moist papules in being sessile, slightly raised above the surface, surrounded by inflammation and infiltration, fissured, and covered with moist, thick discharge. The organism of syphilis is in the discharge and the surface and substance of the outgrowth. These likewise do not extend above the anus in themselves but may provoke secondary infection of the rectum of catarrhal or purulent type. The gumma is essentially a neoplasm although of temporary character under treatment, deeply infiltrates the tissue and may be a prominent and extensive mass, occurring singly or severally. It is of peculiar purple lividity, and has a decided tendency to necrosis at the center whose secondary infection may extend up the bowel. The condylomata acuminata, on the other hand, are not sessile but pedunculated, finely and coarsely fibrillated and lobulated exactly like a cock's comb, dry rather than moist unless between closely apposed surfaces, bleed easily, are very friable and in smaller examples will break off in the fingers. Their discharge contains only the gonococcus. Exceptionally these condylomata are found without the presence of gonococcal infection but with the existence of uncleanly habits and deep folds of the skin especially around the anus and genitals where eczema intertrigo is very common. They then represent a hypertrophic change in the skin due to the eczema and the infection of the organisms present normally in the skin but augmented by the uncleanness of the victim.

The history therefore points only toward syphilis and away from gonococcal infection in the long incubation, development and course of the chancre, appearance and progress of the secondary symptoms

of which these cutaneous anal signs are only a part or of the tertiary symptoms with the incidence and ulceration of the gumma. The subjective symptoms have just been sufficiently stated and should be corroborated by objective examination, both of the general symptoms and of the local outgrowths of the disease, without omission of search for the *Treponema pallidum* and the Wassermann or Noguchi complement fixation tests for syphilis as the chief elements in the laboratory evidence, which after all is final. The treatment, systemic and local, against syphilis is so prompt in its results that it has been called the "touchstone" of diagnosis in these cases, and is of great service in cases giving negative or contradictory laboratory reports.

*Chancroidal differs from gonococcal proctitis* in being primarily an external ulcerative process and secondarily a purulent infection of the bowel which may not occur at all. The history is that of perverted sexual congress or of the presence of chancroid about the genitals and its appearance at the anus by autoinoculation. The subjective symptoms embrace all the irritation, pain, spasm, bleeding and discharge of fissure in ano and the objective findings reveal the typical chancroid with "mouse-eaten or gnawed" base and overhanging ragged edges and purulent slightly hemorrhagic discharge. Proctoscopy, if possible to the patient, reveals a purulent proctitis without the development of condylomata acuminata within the bowel, without adherent scabs and strings and without any of the other signs of gonococcal proctitis, including the gonococcus itself. The laboratory investigation proves the presence of the bacillus of Unna and Ducrey and freedom from the gonococcus in the ulcer and its pus and the pus from the bowel. The gonococcal complement fixation test is negative. Treatment against chancroid and other ulcer is available. The bowel requires no attention unless secondary infection of it shall have occurred. Curetting and section of the sore will reveal the Unna-Ducrey bacillus in the substance of the growth and in the discharge and sloughs from its surface.

**Treatment.**—In the discussion of gonococcal conditions, significance shows that proctitis is one of the more important complications through the lesions produced by direct infection, incidentally through carelessness or intentionally by perversion. The latter is a factor in these cases of grave social moment. The prophylaxis of the disease provides against transmission of pus from the genitals to the rectum by instructions concerning clean hands and disposal of dressings as shown in detail in the printed slips of instruction given in the early paragraphs on treatment. Abortion reaches its aim by early and judicious attack on the first symptom of bacteriologically proved infection.

The particulars of management are enumerated in Chapter IX on General Principles of Treatment on page 483.

**Curative Treatment.**—Removal of exudate is the first step and irrigation is the first method during the period of discharge followed by expectant applications in the chronic period.

The stool should be soft and pultaceous, as in fissura in ano, as

produced by the following formula in one or two movements a day, black and foul-smelling, concerning which the patient should be warned.

R—Flowers of sulphur,  
Sulphate of magnesium, of each . . . . . 1 ounce (30.0 grammes)  
Mix, make a powder and mark:  
One to four teaspoonfuls, as needed, for soft movements.

The physical measures are, in hydrotherapy rectal irrigations as soon as the intense symptoms disappear, at first solvent and cleansing to remove mucus and pus, then antiseptic and stimulating. Sitting baths, hot to produce redness of the skin, decongest the deep pelvic circulation and soothe the diarrhea and tenesmus. In electrotherapy fulguration removes the warts by the same procedure as detailed in this technic for condyloma acuminatum, substituting the proctoscope for the urethroscope. The medicinal measures are standard attention to the urethritis. During the acme, extreme irritation forbids active treatment, but the sphincter may be stretched under nitrous oxide gas anesthesia, as in fissure, and Irish moss lubricant, containing a small amount of novocain or alpin may be inserted as sedative. Morphine and opium suppositories check the pain and the tenesmus, aided by soft stools. Moist antiseptic dressings receive the discharge and keep apposed surfaces from chafing. Serumtherapy offers no advantage. Local administration is involved with the declining period exactly as in urethritis. Through the double current rectal tube or two catheters inserted, side by side, warm normal salt solution or weak boric acid water are run in until the return is clear, followed by solutions of potassium permanganate, 1 in 10,000 to 1 in 4000; silver nitrate, 1 in 20,000 to 1 in 5000; bichloride of mercury, 1 in 10,000 to 1 in 5000. After these, argyrol, 3 to 10 per cent.; protargol, 1 to 2 per cent.; collargol, 10 per cent.; silver nitrate, 0.5 to 1 per cent., may be instilled and retained. In the still later periods the proctoscope or the small Sims speculum in either the knee-chest or the Sims posture is employed for making light applications of nitrate of silver in more stimulating and caustic strengths, 1 to 25 per cent., and its allies to ulcerations and indolent granulations and for fulgurating warts from within the canal or surgically removing them. The anal eczema indicates cleanliness by washing with castile soap and water and thoroughly drying with a towel, aided with dusting powders, such as equal parts of boric acid, thymol iodide and bismuth subnitrate. Painting of the eczema with 10 per cent. nitrate of silver is a strong healing agent against the infection and the relaxation. Dressing to receive the irritating discharge and to separate the surfaces is essential and should be at first moist antiseptic gauze or cotton followed by the same liberally dusted with stearate of zinc and boric acid powder or by a soothing ointment, such as equal parts of 10 per cent. ichthyol and 10 per cent. boric acid.

The surgical measures begin with overstretching of the sphincter ani muscle to correct tenesmus and to permit applications more readily. Through a small Sims speculum or the 10 cm. proctoscope the mucosa



is directly treated and warts may be fulgurated in the exact manner prescribed for urethral growths or surgically ablated. In the latter technic they are drawn forward and clipped through their bases after ligation, so that the wart and its pedicle are ablated. The raw stump may be touched with 10 per cent. silver nitrate. Folliculites are incised, cauterized, drained and dressed in miniature like an ischiorectal abscess. Fissures are incised through the granulating zone to sound muscle tissue and dressed, after the preliminary stretching of the muscle. Sources of discharge are so far as possible located and appropriate applications made to areas of indolent granulation and to pockets accumulating pus. A small cotton tampon soaked in suitable medications may be inserted through the speculum until the next defecation.

*Aftertreatment.*—The chief aim is to restore the mucosa to normal after the infection is removed, which may require weeks and months, exactly as in the urethra. Avoidance of constipating or diarrheal diet and drink is required and full hygiene of the urethritis must never be omitted in order to avoid reinfection.

*Cure*, pathologically, means no proctitis, with its cicatrices and chronic catarrhal discharge, and symptomatically there must be no relapse of the catarrh or the infection from any uncured fissure, follicle or wart and no excoriating mucous or purulent discharge; and bacteriologically the gonococcus must be permanently absent after repeated smear and culture test and the flora of the bowel restored as nearly as possible to the normal. Cure of the urethritis to the standard previously described is a foundation of proper result in the rectal disease. Cessation of unnatural practices is absolutely indicated.

### GONOCOCCAL PERITONITIS.

*Significance.*—Although the peritoneum is not actually an organ of the digestive tract, it is so intimately associated with it that symptoms of peritonitis are locally chiefly digestive. For this reason it was regarded logical to include the complication of gonococcal peritonitis under the heading of complications of the digestive system.

Its significance recalls the fatal results and the late sequels and invalidism which mark peritonitis as one of the most important of all the sequels of gonococcal infection. In the male it is fortunately rare, because there is no direct connection between the urogenital system and the serosa, but in the female it is lamentably more common because the mucosa of the tubes is directly continuous with the serosa. With modern and improved treatment of gonococcal disease it is much less common in either sex than it was in previous generations.

*Occurrence.*—In actual frequency gonococcal peritonitis is in the male a rare disease, never primary but always secondary to or associated with disease of the seminal vesicles, prostate and perivesical region, with burrowing of the pus in the deep cellular planes until the peritoneum is reached. It is much more common in the female, owing to the fact that the Fallopian tubes open directly from the peritoneal



cavity. In children it is most common and usually of fulminating type. The disease in women and children is discussed in Chapter XI on pages 612 and 615.

**Varieties.**—Acute, subacute and chronic, localized and partially or generally diffuse are the forms seen, of which the most usual are (1) in the male, acute localized; (2) in the female, acute and partially diffuse within the pelvic cavity and (3) chronic relapsing with adhesions, especially seen in women.

**Etiology.**—The gonococcus, with its pyogenic allies, is the exciting factor, while the associated disease is the predisposing condition, notably complications in spermatocystitis, prostatitis, both with abscess and involvement of the surrounding tissues. Funiculitis of severe type is a particularly common cause especially where the vas deferens reaches the wall of the bladder from the inguinal canal and, in direct contact with the peritoneum, passes along it to its ampulla at the base. The peritoneal annexa of all these organs in the rectovesical cul-de-sac are the point of onset of the peritonitis.

**Pathology.**—Primary cases never occur, because the gonococcus cannot reach the peritoneum except through complications in and breakdown of neighboring organs in more or less direct relation with this membrane. Secondary cases are, therefore, the one rule. The essence of the process is extension to the serous sac of the abdomen of the gonococcal infection, with or without its common pyogenic allies from a previous point of infection—invariably a complication in the periurethral structures in the male. The tissues involved are the organ in such complication and the peritoneum locally in the strict sense or diffusely within the cavity of the true pelvis or throughout the peritoneal cavity as a whole. The temporary lesions in cases of recovery are those essential to gonococcal invasion—congestion, inflammation, exfoliation, infiltration and purulence, which is relatively scanty in fluid amount but copious in fibrous products with secondary delicate adhesions. The permanent lesions are extensions of these processes into dense adhesions, which displace the intestines and the organs especially in the female, to severe compromise of function, digestive and sexual. The associated lesions are those of the causative or precedent involvement, while the bacteriology is, as stated, the gonococcus with or without its common pyogenic aids. Mixed infection are commonly the most severe.

**Symptoms.**—As in any other peritonitis the gonococcal form has much the same local and general subjective and objective syndrome during the periods of invasion, establishment and termination. The initial symptom of the invasion is usually local, as a severe sudden colic which in children is intense and prostrating. This is followed by chills and chilliness, high fever and the other common signs of infective invasion. In the establishment the subjective systemic symptoms are continuation of the rigors, with high variable temperature, nausea, vomiting, first of bilious and later fecal type, constipation from paralysis of the bowel and exceptionally diarrhea. The objective syste

gns at the corresponding time are the high variable fever, particularly in children, a rapid, tense pulse, intense anxious mind, due usually to the pain and the character of the toxemia. The subjective local signs are extension of the colic into severe pain confined to the pelvis, the lower part or the whole of the abdomen, while the objective points, less in localized than in generalized disease, are tenderness and muscular tension over the seat of the pain, gradual inflation until the whole abdomen is "ballooned." Motion and touch augment the suffering exemplified by the anxious, sallow, haggard expression. Rectal examination commonly reveals the causative focus in the seminal vesicles, prostate and annexa, and sometimes localized tenderness in the cul-de-sac to the examiner with a long finger.

The termination in mild local cases is full recovery, with or without adhesions, which may lead to secondary rectal and intestinal difficulty. More extensive cases may also permit recovery, while the intense generalized involvements commonly terminate fatally.

**Diagnosis.**—Recognition of two facts—the peritonitic process and the gonococcus as the exciting agent—is the basis of the diagnosis. The history is completed by the antecedent intense gonococcal infection with numerous and severe complications, especially those of the prostate and seminal vesicles, with absorption systemically and with extension into the annexa of these organs locally in the male and in the female duplicate processes in the womb, tubes and ovaries. The subjective symptoms are those of intense pain localized in the region of the affected organs with a tendency to advance and extend. Difficulties with bladder and rectum may be present. The objective signs are those first of the initial gonococcal condition and its complications, and second those of the localized peritonitis. In the female through the rectum the cul-de-sac of Douglas may be perceived to have lost its usual freedom and smoothness and to have been replaced by infiltration and adhesions, in association in the male with the diseased prostate, vesicles and vas deferens and in contact in the female with the boggy uterus and invaded tubes and ovaries and sometimes the bladder in either sex. In the male the peritonitis may be suggested by extensive tenderness along the course of the vas deferens within and just above the inguinal canal. On the whole the general character of the fever is less variable and intense in pure gonococcal peritonitis than in the true pyogenic form excepting children and the sudden onset of localized abdominal pain during the activity of any of the essentially severe complications of gonococcal urethritis followed by the other classical symptoms of peritonitis will practically settle the question. The laboratory findings offer suggestive factors in the decision such as the presence of gonococcal infection in the urogenital organs, especially of its complications in those organs which are particularly in relation with, for example, in the male the bladder, prostate, seminal vesicles and vasa deferentia and in the female, the tubes and ovaries. It is obvious that the final decision as to the identity of gonococcal involvement in the peritoneum cannot be reached without recovery of exudate

from the peritoneal cavity which in the male is extremely difficult, but in the female in operative cases is much easier when the organs within the pelvis are freed of adhesions and exposed for the securing of specimens. Only in this sense is treatment of value in the diagnosis. The complement fixation test is very apt to be positive.

**Differential Diagnosis.**—Peritonitis arising during a complicated urethritis may be due to the pyogenic organisms commonly found with the gonococcus in these cases but its recognition would depend on its more active and progressing character and the distinction of the pyogenic germs to the exclusion of the gonococcus in the pus. This would well-nigh be impossible except as an element of operative intervention or autopsy.

**Treatment.**—The fatal issues and invalidating sequels in their significance identify peritonitis as a grave complication and prophylaxis offers no direct means, but efficient indirect means by early and proper attention to the complications in the female involving tube and ovary and by free evacuation and drainage of pus accumulated in the male among the cellular planes of the pelvis seen in abscess of the seminal vesicles, prostate and pancystitis. There is no abortive treatment because when the infection has once reached the peritoneum it cannot be checked but it may be localized and prevented from becoming diffuse. Proper treatment may therefore be abortive of generalized disease.

The student must learn the essentials of management in Chapter IX, on General Principles of Treatment, on page 483.

**Curative Treatment.**—This is active and prompt, but is often of little avail and yet may save seemingly hopeless cases and limit severe infections to one part of the abdomen.

The physical measures offer the ice-cap or the ice-water coil to the abdomen or hot poultices in the hydrotherapy according to the preference of the patient and the benefits of each form of treatment. The Murphy enteroclysis belongs under this heading.

The heliotherapy requires a 500 c.p. therapeutic lamp slowly waving over the affected part for at least thirty minutes four times a day and persisted in until subsidence of symptoms, which is induced by the intense hyperemia, increase in the resistance and activity of phagocytosis followed by relief of the pain. The electrotherapy applies the hot electric coil, if heat is beneficial, or the x-ray in the chronic stages to promote absorption of extensive exudate. The current is 3 milliamperes, backing up a 4 inch spark gap at the negative terminal of the x-ray tube placed at a distance of 10 inches from the part, under the protection of 3 mm. of aluminum upon either 4 layer of chamois or 1 layer of sole leather. The duration is fifteen minute but varies with the result and the frequency is alternate days for treatments and then two times a week. Unfavorable reaction unknown in competent hands.

All medicinal measures suggest small doses of calomel or sulphate of magnesium to avoid stasis of the bowel followed by paralysis at

distention but are given cautiously if there is diarrhea. Small doses of opium derivatives to ease spasm and pain are required; the use of large doses of opiates to control all spasm and pain is no longer advised on account of its disadvantages of constipation, prevention of absorption of exudate, masking of new symptoms and sometimes depression. On the other hand, a single large dose will relieve the shock of intense pain, especially in a perforating case. Splanchnic vascular paralysis with secondary cardiac paralysis is seen in diffuse peritonitis and Koltz<sup>1</sup> gives pituitrin for the low blood-pressure, ileus and ischuria of such paralysis.

The surgical measures never neglect the focus of onset, such as spermatoecystitis, prostatitis and pancystitis, any or all with abscess and involvement of the surrounding tissues. The nonoperative means are Fowler's position and Murphy enteroclysis as noted on page 415. The operative technic rests on the severity of the symptoms and the type of the infection present. The latter is often impossible to determine. Operation may be immediate or postponed with both dangers and benefits. Immediate interference may excite an inflammation which would otherwise decline and postponed operation has the dangers of advance in old and of appearance of new lesions with adhesions and invalidism, relieved only by later operation. Its benefits make the operation one of election, greater safety and often better immediate and remote functional results. Minor operation is blood-letting in sthenic patients, with localized peritonitis a small quantity of blood being withdrawn. Even multiple leeches helpfully reduce pressure and remove toxins.

The major operation is laparotomy by incision, evacuation and drainage of the abdominal cavity, without or with flushing, irrigation or mopping. The selection of case concerns local and diffuse peritonitis. The local cases have focal inflammation, symptoms and exudate, with comparatively little systemic disturbance, much as is seen in some forms of appendicitis and pus tubes. Relief comes with incision, evacuation, cleansing and drainage analogous to an abscess. The generalized peritonites have diffuse abdominal pain and most intense systemic symptoms in contrast, especially in cases of general peritoneal septicemia proceeding from postoperative infection, puerperal fever, strangulated hernia, intestinal obstruction and the like. Relief of these cases is not unlike removal of accumulated poison from the stomach. Operative energy against the cause of the peritonitis is imperative.

The instruments and supplies are scalpels, scissors, forceps, hemostats, ligatures, retractors, sponge-holders, gauze sponges, intestinal pads, return flow irrigation tube, assorted needles, including intestinal needles, needle-holders, sutures, drains and abundant hot, normal salt solution. The preparation of the patient usually omits catharsis and of the field is the standard iodine application for the skin and the

<sup>1</sup> München. med. Wchnschr., September 17, 1912.

anesthesia is general and well within any danger of depression. Ether for its stimulation is preferred. The posture is supine or Trendelenburg's, according to accessibility of the essential deep field. The landmark is the middle line of the body from the symphysis pubis to the xiphoid cartilage. The incision in localized peritonitis is over the point of most prominent symptoms, most commonly the pelvis in gonococcal cases in both sexes, and in generalized peritonitis it is extended upward to give free entrance to the infected cavity. The midline is preferred, marking the superficial field between the recti muscles or through the sheath of one with separation of the fibers or pushing of the muscle aside. The deep field embraces all pockets in diffuse peritonitis, commonly reaching the pelvis last, because the most dependent, and embraces in local peritonitis the obvious center of accumulated pus. Distended intestines are aspirated free of gas and fluid and the needle holes are stitched tight.

The steps of operation are individualized according to serous exudate, purulent exudate and fibrinous exudate, with the modern tendency to do as little manipulation as possible, and far less than formerly.

In localized peritonitis, usually purulent, the pus is evacuated through the wound walled off with gauze from the general peritoneal cavity if not so by adhesions. The walls of the abscess are gently mopped clean and free drainage, with cigarette gauze drains or rubber tubing fenestrated but without sharp edges or corners, is established. A copious dressing covers the wound often narrowed to near the drains and after two or three days, cleansing and drainage are encouraged by gentle irrigation.

In generalized peritonitis, if serous, the abdomen is opened through the middle line and as much of the exudate made to escape as possible, so as to turn the balance of the infection in the patient's favor by eliminating much infectious material. The wound is then sewed up without drainage and commonly recovery occurs. Much credit is due to R. T. Morris<sup>1</sup> for the development of this simple, safe plan. If the exudate is seropurulent or purulent a larger incision and irrigation with the return-flow, soft-rubber or metal tubes are required in many cases. The dependent pockets of the cavity are gently washed first until the return is clear, so as not to float infectious material gravitated into them about the cavity. After this the coils of the intestine may be cleansed by washing and gentle mopping, always with the protection of hot towels against chilling. As little fluid as possible is left in the abdomen and cigarette drains are carried to all depths. Counterdrainage through the loin is less commonly employed than formerly, but may be reserved for extreme cases.

The stasis of the bowel in any form of peritonitis, through distention, is relieved by aspiration of gas and fluid contents and often by injecting into it concentrated solutions of sulphate of magnesium.

In the fibrinous or plastic peritonitis, with the intestines patched with

<sup>1</sup> Lectures on Appendicitis and Notes on Other Subjects, 1899, pp. 64, 65, 66 and 84; Dawn of the Fourth Era in Surgery and Other Short Articles Previously Published, 1910, pp. 39 and 117.



fibrin and adherent in many places, it is usual to remove the loose exudate from the cavities with irrigation and mopping in the same manner as described, leaving little or no fluid behind, and to mop the less adherent patches away. Adhesions are gently broken down and the raw surfaces sometimes turned in with Lembert stitches to prevent return if the patient's condition permits, but if Nature's processes have been efficient they may be left alone. If a perforation is walled off it must be exposed and closed with banked Lembert stitches. Cigarette drains may be used into any pus cavities in these cases.

The cause or source of peritonitis should in most cases be sought and remedied if other conditions of the patient and operation permit. When gonococcal infection is suspected as the sole cause the tendency to delay operation is great. Drainage is not used in the serous cases and is much more sparingly employed in the purulent and fibrinous cases than formerly, and lastly counterdrainage through the loin is a final resort. In the milder cases the tendency is to follow Morris's teaching of opening the abdomen, evacuating much of the exudate, closing it and leaving the disease to nature and medicinal means. Suture is by layers, with careful closure of all dead spaces.

*Aftertreatment.*—In the immediate steps for from three to seven days the drains are left alone and loosened without pulling, when they give way themselves and they are omitted when the temperature is nearly normal and the discharge scanty. The outer dressing is kept clean by frequent changes and a special day and night nursing is advisable. Diet is nutritious and light but sufficient to maintain strength and gradually increased with the improvement. Vomiting indicates nutrient enemata if no diarrhea prevents. The gentle use of calomel aids the action of the bowel and liver, and stimulation against absorption is required. The remote aftertreatment observes attention to the gonococcal focus and restores the defective nutrition and depreciated strength of the patient. Anemia is often common for long periods due to the infection and adhesions and invalidism often require late operations for their relief.

*Cure.*—Cure involves not only saving the life of the patient but so far as possible restoration of the abdominal contents to as nearly as possible normal positions and full physiological function.

### 3. *Circulatory Complications.*

*Occurrence.*—The cardiovascular system does not escape gonococcal infection. The antecedent focus is always severe and profound. The arteries and veins are not often involved. As a less uncommon but severe complication, the heart, in its valves, lining, muscle and sac, may be attacked at any period of acute or chronic disease. These lesions are beyond doubt, as frequent autopsies have proved the organism in the serous membrane and the blood. Luys reports at least 100 proved cases in literature.<sup>1</sup> Males seem to be more frequently attacked than females.

<sup>1</sup> Text-book on Gonorrhea, 1913, p. 226.

**Varieties.**—Classification of cardiac complications is, as to site, endocardial (the most common) and pericardial and myocardial (the less common and almost always secondary to endocarditis). All three may occur as one intense disease process.

#### *A. Cardiac Complications.*

##### **GONOCOCCAL ENDOCARDITIS.**

**Occurrence.**—Endocarditis is frequent, important and practically always primary with reference to myocarditis and pericarditis.

**Varieties.**—Clinical subdivisions are primary, secondary, acute, subacute, chronic, complicated and uncomplicated. The valvular forms are aortic, mitral, pulmonary and tricuspid.

**Etiology.**—A severe gonococcal focus is present—urethral, prostatic or seminal vesicular. The endocarditis appears after or during the gonococcal bacteriemia.

**Pathology.**—The suppurative gonococcal focus is essential. In the heart are found valvular inelasticity, thickening, vegetation, ulceration, perforation, deformity and sometimes thrombi. Myocarditis and pericarditis may be associated.

**Symptoms.**—Conditions duplicate those of any other septic, acute endocarditis in subjective and objective syndromes and physical signs. The termination is also similar.

**Treatment.**—The treatment is as described at the end of this subject on page 230.

##### **GONOCOCCAL MYOCARDITIS.**

**Clinical Features.**—Myocarditis is always associated with endocarditis in occurrence, etiology, pathology, symptoms and treatment.

##### **GONOCOCCAL PERICARDITIS.**

**Occurrence.**—Pericarditis is rarely primary, but usually secondary to endocarditis.

**Clinical Features.**—Varieties, pathology, symptoms, diagnosis and treatment duplicate those of other forms of this lesion.

**Diagnosis.**—Recognition of the primary, septic, gonococcal focus is essential, also definite, subjective and objective cardiac syndrome with complete laboratory analysis.

**Differential Diagnosis.**—The gonococcus alone is the deciding factor.

**Treatment.**—The gonococcal point of absorption must be cured. The cardiac conditions are managed the same as those of other types of each disease.

#### *B. Vascular Complications.*

**Varieties.**—Aortitis, phlebitis and thrombosis are the three lesions seen in gonococcal septicemia. All are rare in occurrence.



### AORTITIS, PHLEBITIS AND THROMBOSIS.

**Occurrence.**—These vascular signs are very unusual except in septic bacteremia.

**Pathology.**—The gonococcus is added to the common lesions of acute inflammation of other origin. They are associated with those of the cardiac foci and the septicemia.

**Symptoms.**—The characteristic syndrome is present as seen with other infections, together with that of the primary gonococcal focus.

**Diagnosis.**—Many cases require postmortem data. The primary gonococcal lesion must be proved and the case recognized through its symptoms and other laboratory evidence.

**Treatment.**—Original lesions must be cured. Circulatory conditions are managed in the usual ways.

### GONOCOCCAL SEPTICEMIA, BACTEREMIA AND TOXEMIA.

**Definition.**—Gonococcal septicemia is a condition induced by the absorption of septic products from a gonococcal process; bacteremia is an analogous state in which the living gonococci are present in the blood, and toxemia is a disease-process of the blood containing poisonous products, due to the growth of gonococcus in the blood. These three terms are used more or less indefinitely and interchangeably to denote generalized infection with the gonococcus. The term gonococcemia<sup>1</sup> is sometimes used.

**Significance.**—Gonococcal septicemia and its analogues, bacteremia and toxemia, give a new interpretation to gonococcal infection founded on the advances of modern bacteriology and hematology. In the older and even best authorities, such as Taylor,<sup>2</sup> in America, definite mention of these lesions is entirely omitted. Knowledge of this pathological entity converts gonococcal infection from solely a local into occasionally a systemic disease, intrinsically due to the penetration of the gonococcus from an antecedent focal lesion into the blood and its circulation there, with secondary deposit in almost any organ or tissue, or due to the absorption of septic products and their circulation, through the blood stream. In this detail it duplicates any other form of septicemia and its allies.

While strictly not a circulatory complication, the blood as an organ is primarily and in a sense preëminently concerned. For these reasons, therefore, in this work it is treated as an involvement of the circulatory system.

Probably no extragenital complications of gonococcal infection whatever, excepting such accidents as ophthalmia which may occur from mediate or instrumental transference, may arise without the presence of septicemia or bacteremia in mild or severe degree. This rule

<sup>1</sup> A hybrid word gonohemia meaning literally seed or semen in the blood, which is as far as possible removed from gonococcal septicemia, is sometimes used and without etymological reason or excuse.

<sup>2</sup> *Loc. cit.*

undoubtedly holds in manifestations within the cutaneous, central and peripheral nervous and locomotory systems, as later described and exemplified by rashes, meningitis, neuritis and neuroses, myositis, arthralgia and arthritis, periostitis and the like.

All these lesions may be embraced under the hemic classification, because none can arise without the action of the bacteria or their toxins circulating in the blood and primarily depositing at various and numerous points and secondarily extending. The cardiac foci are therefore the pericardium, endocardium and the muscularis, and the vascular locations are the chief trunks of the aorta and veins followed by thrombosis and the hemic site is the blood itself regarded as an organ with a fluid matrix and floating cells. Arthritis belongs to the same class but is discussed in itself, likewise metastatic abscess.

That gonococcal infection as a cause of death is not a medical curiosity is shown by numerous thoroughly diagnosticated cases in literature. Examples of such reports are the following: Brewer<sup>1</sup> has noted a case of fatal gonorrheal infection with autopsy report; Cornell<sup>2</sup> describes a case of gonorrhea rendered fatal by its sequelæ; Fenwick<sup>3</sup> has observed a case of gonorrhea ending fatally; Kossmann<sup>4</sup> has seen two cases of death in consequence of gonorrhea; Post<sup>5</sup> saw one patient die directly from the gonorrhea, and Robinson<sup>6</sup> discusses systemic infection from gonorrhea with report of a fatal case.

**Occurrence.**—In general frequency, septicemia is rare when compared with the vast number of gonococcal sexual involvement in men, women and children. Never primary but always secondary to such genital lesions, it is more frequent in males than in females, in pregnant than nonpregnant women, and in children than adults. Males suffer most doubtless through the greater incidence of the disease upon this sex in the general nature of their social relations, while low resistance is doubtless at work in pregnant women and children. It is more common in posterior than in anterior urethral disease, and in complicated than uncomplicated cases, although initial anterior disease has been known to cause it. Of the complications the extraurethral lesions, such as prostatitis, seminal vesiculitis and epididymo-orchitis in the male, and salpingitis and ovaritis in the female predominate in its occurrence, and not uncommonly in old rather than recent cases, in which subjective symptoms may be practically absent.

**Varieties.**—Varieties cover the major subdivisions of the hemopoietic system as shown in the clinical section but their treatment had best be considered under septicemia, bacteremia and toxemia, because it is obvious that none of them can arise without these basal conditions. The cardiac lesions are endocarditis, pericarditis and myocarditis, the vascular invasions are aortitis, phlebitis and thrombosis,

<sup>1</sup> Jour. Cutan. and Gen.-Urin. Dis., 1897, xv, 260.

<sup>2</sup> Montreal Med. Jour., 1900, xxix, 100.

<sup>3</sup> British Med. Jour., 1899, ii, 1544.

<sup>4</sup> München. med. Wehnschr., 1900, xlvii, 395.

<sup>5</sup> Boston Med. and Surg. Jour., 1887, cxvi, 417.

<sup>6</sup> Med. News, 1896, lxi, 230.

and the hemic disease is the septicemia, bacteremia and toxemia. Metastatic abscess belongs in this class, but is separately discussed for convenience. Arthritis is in a class by itself also, but belongs to this general group of lesions dependent on the circulation of bacteria and their toxins in the blood.

**Etiology.**—The factors are predisposing and exciting, systemic and local. The predisposing elements are lowered general vitality, shown by a naturally poor resistance to most diseases, a history of which is commonly obtainable, or from the actual presence of such systemic disease as diabetes, nephritis, syphilis and tuberculosis, and likewise lowered local vitality due to rough instruments, unskilful application of instruments, and congestion from venereal excess, alcoholism, concentrated solutions, and undue frequency or activity of treatment.

The exciting cause is regularly the gonococcus either in pure infection or associated with other organisms of the pyogenic species, notably the streptococcus, staphylococcus, and the *Bacillus coli communis*, which add to the seriousness of the case. It seems that as long as the gonococcus persists in active or chronic, anterior or posterior, complicated or uncomplicated urethritis, septicemia may at any moment suddenly appear, with or without assignable cause. The ports of entrance are in the mucosa, points of denudation, or ulceration through the inflammation, or of traumatism through instrumental or other treatment, and are in the organs involved in any complication or in local destruction or abscess formation of even minute size and chronic type. It is peculiar that so few cases of gonococcal septicemia occur in the ordinary circumstances and course of the disease so that one may say that perhaps the organism does not usually thrive in the blood stream. If this were otherwise metastases containing the gonococcus would be the rule instead of the strange exception. Hematology will later decide this point.

The basis of the complications of septicemia, bacteremia and toxemia is therefore the presence of the gonococcus or its products or both within the bloodstream and their diffusion through the body. Three avenues of origin are described: that is, hemic and lymphatic, involving perhaps, chiefly the bacteria themselves, and toxic involving, perhaps, mostly the products from the antecedent condition or source, or from the growth of the organism after reaching the blood, or after its deposit in various remote organs. The order of frequency of these origins is, as stated, hemic, lymphatic and toxic. Thayer and Blumer<sup>1</sup> were the first to prove during life pure cultures of the gonococcus in the blood, while Uysing<sup>2</sup> followed by demonstrating it in the lymphstream. Such proofs, however, are most difficult even in the presence of active septicemia, probably because the organisms are not numerous, relative to the bulk of the blood, and through their tendency to penetrate tissue they may still further undergo apparent reduction in number;

<sup>1</sup> Arch. de méd. expér. et d'anat. path., Paris, November, 1895. Johns Hopkins Hosp. Bull., 1896, vii, 57.

<sup>2</sup> Inaug. Dissert., Kiel, 1900.

and furthermore, the technical difficulty of cultivating the gonococcus especially when present in mixed infection, cannot be overlooked as an obstacle. These factors excite the circumstance of difficulty rather than facility in finding the organism, although it grows best in media containing human blood serum.

**Pathology.**—Primary cases of gonococcal septicemia are unknown as this complication and its allies is always a consequence of urethral or other local infection. The pathogenesis does not differ in any material detail from that of septicemia from any other organism and its products. The essence of the process is the circulation in the blood of the gonococcus with its septic and toxic products, after a port of entrance has been created on the surface of the mucosa, within the substance of a gland like the prostate or the cavity of an organ like the semivaginal vesicle or Fallopian tube, through inflammatory or accidental factors, both. The organs and tissues involved include all. None escape, although most commonly the serous membranes are first and chiefly involved, perhaps through their structural analogy with the mucous membranes. Thus there are found in the circulatory system endocarditis and pericarditis; in the respiratory, pleuritis; in the digestive, peritonitis; in the nervous, meningitis; and in the locomotory system, arthritis and tenosynovitis. The meninges are not serous, but delicate and susceptible tissues. Temporary lesions may be said to occur in the least involved tissues and in cases of recovery which seem to comprise about two in every three cases. Permanent changes, however, are very common in the serosæ attacked, and the associated lesions are naturally the antecedent condition or complication, and finally bacteriology is always the gonococcus alone or in association with other organisms.

**Symptoms.**—As in other septicemia, that caused by the gonococcus has a various and uncertain symptom-complex, with on the whole no new features, and indistinguishable from such other septicemias excepting by hematology and the history of localized antecedent gonococcal involvement, uncomplicated or complicated, acute or chronic. Subjective symptoms in the strict sense are, excepting rarely in mild cases, absent. The patients are too ill in severe cases in degree and duration of disease is too rapid in progress to permit a subjective picture. Objective symptoms, on the other hand, predominate and vary widely in their constancy, association and degree. Periods of invasion, establishment and termination may be distinguished usually in the systemic less often than by local conditions. The latter are common foci of the deposit or infarct in some important organ or system, part of the general septicemia and bacteremic process, and constitute practically a new group of complications of extragenital type, such as endocarditis, meningitis, and arthritis, as examples. No description may be given for all cases and reports in literature emphasize the dominance of one symptom over another largely in accordance with this element of infarct. All the symptoms are, therefore, elements of general systemic disease, while definite syndromes mark the inva-

of a given system preëminently over other systems. The general course may be mild, severe or intense.

The period of invasion is usually accompanied by sudden decrease or even cessation in the local symptoms, such as a urethritis or one of its active complications, or the invasion may suddenly issue out of a clear sky, that is, during the seeming absence of any local activity. There are commonly chill and chilliness, a sudden high fever with wide variations, or a moderate fever of more or less constant range (according to the resistance of the patient) with profuse perspiration and digestive disturbance. After establishment the symptoms continue and commonly augment. The perspiration is followed by sudamina, or a variously papular eruption containing the gonococcus. The digestive disorder is nausea, vomiting, diarrhea or constipation, all of moderate or severe degree. The fever is of the true septic type, low in the morning, high at night, with wide differences, or more constant in its average and much less in its range. The nervous system at first is stimulated into active delirium and then depressed into stupor, coma and death. The circulatory system early shows cardiac weakness, disturbance and insufficiency. Splenic and hepatic enlargement have been noted. Except in the cases of short duration and fatal outcome emaciation and anemia are profound. Protracted cases may show carphology, low muttering delirium, subsultus tendinum and finally wasting death. The blood test reveals the gonococcus alone or with associated organisms in the blood, leukocytosis of from ten to thirty thousand, and anemia. The kidneys reveal various forms and degrees of acute nephritis usually with exudation of albumin, casts, blood and pus.

The objective local symptoms of the foci of deposit and infarct may complicate the picture at any time, and distract the attention from the general to such local manifestations. Thus the chief symptoms may be due to the endocarditis, pericarditis, arthritis, pleuritis, pneumonia or meningitis, which in its turn is very difficult to distinguish in its symptoms from those due to the septicemia itself.

The termination is fatal in only 30 per cent. of cases, according to Luys,<sup>1</sup> but cases favorable at first may later have a lethal issue. The outlook for health is otherwise, especially when any of the complications produced by the septicemia arise as just stated. Relapses are not uncommon as might be expected from the nature of the chronic foci from which these cases often arise. The most serious cases are those with cardiac involvement as few escape without materially damaged valves. Cases with recovery usually have a slow course until good health is restored. The mild cases result in full recovery. In fact, it has been shown that a few cases of gonococcal urethritis have the organisms circulating in the blood without active septicemia.

**Diagnosis.**—The only facts in the history are that the symptoms arose during the course of acute vicious gonococcal urethritis or at the onset of acute complications or in the exacerbation of chronic urethritis and

<sup>1</sup> Loc. cit., p. 35.

its complications and even rarely in the midst of quiescent condition with unexplained cause.

Inasmuch as the subjective symptoms duplicate those of septicemia from other organisms, bacteriological research will alone distinguish the gonococcal form from all other forms and will require isolation and culture of the gonococcus from the blood and from such foci as may appear in the skin, joints and the like. For objective signs it is well to search the urogenital organs in males and females for an unsuspected and more or less active and even comparatively inactive focus. The presence of such a lesion in active form should at once attract attention. Laboratory proof is essential. It has been suggested that the moments of intermission and remission in the fever of septicemia are, as in malaria, the best times for looking for the organisms in the blood. The gonococcal complement deviation test is still in its development, but should never be omitted in these cases. It is perhaps particularly helpful in the female in whom so many unsuspected deposits of the disease occur. It thus follows that in many patients, males or females, a clinical cure is reached before a serological cure, a fact which only emphasizes the importance of serology in this and allied diseases. Treatment is not an aid in the diagnosis except as it may uncover and relieve an obscure focus of origin of the absorption and furnish suitable exudate and specimens for the pathologist.

**Differential Diagnosis** rests almost solely on identification of the gonococcus in discharge, exudate or secretion of sexual glands as circulating in the blood and on the complement fixation test for its presence in the system.

**Treatment.**—To larger works on general surgery and medicine resigned the amplified treatment of septicemia but the following suggestions are of great value. Prophylaxis offers no direct relief, as the patients show low resistance, early bacterial and toxic absorption and their results. Indirect prevention, however, underlies the best possible conservative treatment of severe gonococcal lesions and the evacuation of pus foci, such as abscesses in the seminal vesicles and prostate. Abortion is *ipso facto* impossible because the disease is well established at the earliest possible symptom.

Chapter IX on General Principles of Treatment explains the essentials of management on page 483.

Physical measures cannot be applied in the acute stages as the patients are too sick and the character of these measures tends to disturb quiescent foci. In hydrotherapy hot-packs for elimination through the skin and support of the kidneys are valuable and enteroclysis adds stimulation of the circulation, cleansing of the blood through absorption and probably elimination by bowel, kidneys and skin. In the chronic period of surviving cases as passive muscular activity is advised and hydrotherapy for stimulation and elimination and for the treatment of some focal disease such as the remnant of original complication.

The heliotherapy is actinic, thermic and eliminant in its function.

selected cases and is applied with a 500 c.p. lamp with a suitable reflector travelling slowly over the surface in the manner described under Peritonitis, page 220. The duration is from a half to one hour at each sitting and its frequency is several times a day, and in an institution even oftener. Alternation with electrotherapy is well. Its results are intense hyperemia, relief of vascular spasm, nervous irritation and pain and increased phagocytosis.

The electrotherapy consists solely in diathermy on local manifestations or foci in any organ. The electrodes must be each of the same size, never smaller than twelve square inches in area (3 x 4 inches), and must be placed at opposite sides of the affected area so that the lesion shall be as far as possible fully within the field of the electrodes. The current is 4 to 5 milliampères and no more and the duration is from ten to twenty minutes with a frequency of daily at first and later three times a week until relieved. With skill there is no unfavorable reaction, but small electrodes will cause burns. Alternation with heliotherapy is of value and should be the usual procedure.

The medicinal measures are in the acute period very important, but usually of little avail. On account of the negative phase, serum-therapy is rather risky, as it may only add to fatalities. Small doses, carefully watched, are to be tried if at all. By systemic administration, stimulation, support, sedation and elimination are the methods. Quinin is often good as antiseptic and febrifuge and no stimulant is better than alcohol as whisky, champagne and port wine. It is an easily oxidizable food in these cases and is given short of intoxication. Strychnin is an excellent nervous and circulatory support and morphin is indispensable for pain, restlessness and insomnia, with caution not to mask other symptoms. Elimination through the bowel and skin must never be neglected.

In reference to special organs and systems of the body as attacked require treatment so minute that the reader is referred to large works on general medicine for it. The general principles are, however, mentioned under appropriate headings: Acute and chronic endocarditis, myocarditis and pericarditis are detailed under cardiac complications, aortitis, phlebitis and thrombosis are discussed under vascular sequels of gonococcal disease, while metastatic abscess and arthritis are reserved for separate attention on pages 235 and 248.

Other general principles of treatment are important. The bowels must be evacuated through cathartics by mouth and enemata into the rectum and lower colon. The condition of the gastric and rectocolonic mucosa determines tolerance for the drugs administered and the results of treatment. Cathartics of value are the following: Calomel, in  $\frac{1}{10}$ -grain doses, every quarter-hour, or in  $\frac{1}{4}$ -grain or  $\frac{1}{2}$ -grain doses every half hour, until the bowels begin to move, may be tried. Soft capsules of castor oil, drams 1 to 2, may be repeated until evacuation occurs, if the patient can swallow them. Magnesium sulphate or magnesium citrate, from 1 teaspoonful to 1 wineglassful, at quarter or half-hour intervals, is a good adjuvant of the calomel after



its limit has been reached. One or two drops of croton oil may be added to one administration of the other cathartics if ileus is threatened in a case of septicemia with peritonitis.

The enemata may be warm normal salt solution which by its bulk stimulates the bowels to move or soapsuds combined with oxgall, turpentine, Epsom salts and similar stimulants of peristalsis according to indication. Slow administration is the secret of colonic enemata, which are often necessary before a result is reached.

Direct absorption into the circulation of corrigents of the infection may be secured by inunction and intravenous injection. The unguentum argenti colloidalis of Cr  d   may be rubbed into the skin in 1 dram doses once a day and the intravenous injection of 2 per cent. emulsio argenti colloidalis may be given once a day to the limit of 15 grains. The inunctions and intravenous injections may alternate by days or by longer periods.

The dilution and elimination of the poisons by the kidneys is secured by the intake of large quantities of fluid by any of the following methods. The Murphy drip is of great service and may be applied for periods of one to two hours, with a period of rest between. Normal salt solution is the fluid and the rectal tube is gently passed as high up the bowel as possible. When tolerance of this method fails small enemata of normal salt solution may be run into the bowel every two to four hours and retained by the patient. Free water drinking is likewise of value for this purpose when the stomach tolerates it.

The surgical measures are nonoperative and operative, of which, of course, the latter are by all means the most important. The non-operative details differ in no respect from the means already spoken of under medicinal measures. The management of dressings is also important. The dressings and drains should be at once removed if there has been an operation, such as for prostatic abscess, to cleanse the wound, evacuate accumulated pus and exudate and otherwise remove a source of absorption through this path. No subsequent dressings or drains must again repeat such retention.

The operative measures are major and minor operations, dependent entirely on the nature and extent of the primary nidus and the accessibility of the secondary septicemic foci.

Among the minor operations are to be mentioned the free opening, evacuation, drainage and dressings of abscesses, the infusion of normal salt solution under the skin or its injection into a vein and the transfusion of blood. The technics of all these procedures are so familiar that they will be omitted here. The intravenous injection of 2 per cent. magnesium sulphate in  $\frac{1}{2}$  to 1 pint doses daily for days or of 2 per cent. emulsion of colloidal silver (Cr  d  ),<sup>2</sup> in 15-grain doses daily, for several days, belongs in this category. A needle is simply passed into the vein exactly in the method followed in the administration of salvarsan.

The major operations are attacks on all accessible foci of infection

<sup>1</sup> XII Congr  s internation. de m  decine, Moscow, 1897, v, 349.

<sup>2</sup> Loc. cit.

which must be evacuated to prevent further absorption. Involved joints are opened and drained, abscesses of the glands of Cowper, the prostate and the seminal vesicles in the male and the vulvovaginal glands, the uterus and tubes and ovaries in the female must all be freed of accumulated pus. Hysterectomy and curetting are methods of dealing with an infected uterus according to severity of the lesion. In peritonitis as a lesion of the septicemia a rapid laparotomy is indicated with judicious irrigation by the return flow method of all pockets followed by thorough mopping out and multiple drainage and finally by the use of Fowler's position. The exact technic of all these operations belongs to works on general surgery. If an operation has been done stitches must be removed and the wound cleansed of even trifling foci of pus because it must be remembered that many of the most intense infections have little accumulation of pus about the wound. It must be remembered that in generalized peritonitis of severe type little treatment is of avail and that death is prompt and dreadful from the suffering of the patient. On the other hand, localized peritonitis of the pelvic type, especially in women, is a hopeful disease when treated promptly and well in accordance with the foregoing methods. In general, gonococcal peritonitis is less severe than that due to the streptococcus and the staphylococcus. When combined with the latter, however, it becomes equally deadly.

In localized foci treatment succeeds well as the evacuation of abscesses, the removal of stitches and the cleansing of wounds all followed by the application of the tincture of iodine and the insertion of an alcohol wet dressing.

*Intravenous Injections of Magnesium Sulphate.*—This method is limited in literature to streptococcic bacteremia. Harrar<sup>1</sup> reports a number of remarkable results of these injections when administered to patients suffering from living organisms circulating in the bloodstream. This method is inserted here in this work because a certain number of systemic infections during gonococcal lesions are associated with the streptococcus. It is possible that this method may be of value when organisms other than the streptococcus are circulating in the blood.

As described by Harrar the following details are embraced in the technic of the injections: "A 2 per cent. solution of chemically pure magnesium sulphate is prepared with freshly distilled water. This is filtered and sterilized in half-liter flasks in an autoclave. This solution will not hemolyze human red blood cells, and I have found by experience that prepared in this way it will not cause any temperature reaction in the patient. Formerly a 1 per cent. solution of magnesium sulphate in physiological salt solution was employed, and a chill or sharp temperature rise frequently followed the injection. A simplified salvarsan apparatus is preferable for the injection but the ordinary infusion set will answer the purpose quite as well. It is important not

<sup>1</sup> Am. Jour. Obst. and Dis. of Women and Children, 1913, lxxviii, No. 5.

to cut down upon the vessel, as by direct puncture the same vein can be used a number of times. As many as eight punctures of the same vein have been made on different occasions. The secret in getting into the vein is to make it markedly prominent. This is done by temporarily placing a constricting rubber tube about the upper arm just tightly enough that the faintest pulsation may still be felt in the radial artery. If the constriction about the upper arm is too tight, the arterial as well as the venous circulation will be cut off and the vein will not distend with blood. The needle is inserted in an oblique direction, the spurting of blood from the open end indicating proper entrance into the vein. The rubber tube of the reservoir with the solution flowing is then rapidly slipped over the shoulder of the needle. The reservoir is held at not more than one foot elevation, which will run in 400 c.c. of the solution in about twenty-minutes. The injection should be made much more slowly than the ordinary saline infusion.

"The patient experiences a sensation of heat toward the end of the injection, and frequently feels faint, although the pulse usually gains in quality. A small drink of hot whisky or aromatic spirits of ammonia will steady her. Occasionally the respiration assumes a sighing quality, but no decrease in rate or in depth of the respirations has been observed. It is quite evident that the dangers are not so marked, the drug is not so toxic, when given intravenously, as when employed intraspinaly where it is applied directly to the nerve tissue. I have given as much as 400 c.c. of a 2 per cent. solution intravenously simultaneously with 400 c.c. by hypodermoclysis, representing 16 grammes or 250 grains of the drug, with no alarming effects. Whereas by intraspinal injection for the production of anesthesia, or in the treatment of tetanus, Meltzer<sup>1</sup> advises 1 c.c. of a 25 per cent. solution per 20 pounds of body weight, or about 25 grains for a 130-pound individual, as the safe limit. The injections should be repeated every second or third day according to the course of the infection as revealed by the temperature chart.

"The method has now been employed in fourteen cases at the Lying-in Hospital. In five of these there was a streptococcic bacteremia as proved by blood culture. The other nine were all severely infected women with high temperature and acutely ill with streptococcic toxemia, with pure growth of streptococci on uterine culture, but with negative blood cultures."

As already stated, it is more than probable that this method will be of great value in cases of gonococcic septicemia of the mixed type with the streptococcus as one of the invaders. His series of patients Harrar<sup>2</sup> estimates as now fifteen or twenty cases of proved bacteremias, with success in about 50 per cent., without looking up actual records. He recently employed it in a case of colon bacillemia with prompt improvement after one infusion and disappearance of the bacilli from the blood in a very ill woman with pyelonephritis of pregnancy.

<sup>1</sup> Jour. Pharm. and Exp. Therap., 1909-10, vii.

<sup>2</sup> Personal letter to the author, December 18, 1916.



The effects of the injections are an air hunger if the fluid is too rapidly administered. The first dose is usually followed by a fall in the temperature and by a decrease in the number of organisms in the next blood specimen. If such second blood culture is sterile no other injection is given. If, on the other hand, there is no improvement in the clinical condition or in the blood examination the injections are repeated, every second day, with no ill effects if care is exercised as to all the details. Harrar in a personal letter to the author states that he has given fifteen injections on one case and that the average is from two to seven injections.

In his article Harrar draws the following conclusions:

1. In the quantities and dilutions described, magnesium sulphate is absolutely harmless when administered intravenously to women suffering with puerperal infection.

2. Magnesium sulphate is of more value early in the course of the infection than after secondary localization has occurred. In the chronic cases of secondary thrombophlebitis or pyemia it does not appear to be of benefit. Its action seems to be chiefly upon the organisms circulating in the blood.

3. It shortens the course of the bacterial toxemias in which the bacteria cannot be demonstrated in the blood by culture, and anticipates the establishment of a bacteremia.

4. It has reduced our mortality in puerperal bacteremia, especially in streptococcemia, the most fatal form of puerperal infection, from 93 per cent. to 20 per cent.

*Aftertreatment.*—When the patient survives all immediate measures are directed to the care of the surgical procedures necessary for the heroic combat with the disease. The remote aftercare continues attention to the kidneys, which may otherwise pass into chronic nephritis, and to the circulation and the blood, lest similarly the cardiac muscle be damaged and anemia of troublesome type supervene. Sequels from organs damaged by operation or the disease must also be corrected and in short chronic invalidism avoided.

*Cure.*—Relief of the infection in the immediate present and restoration of health in the early future are the standard of cure. Pathologically, removal of all lesions is often impossible but symptomatically the patient may live for years in comparative or absolute good health.

### GONOCOCCAL METASTATIC ABSCESS.

*Significance.*—The abscess is a sign of acute or chronic septicemia and absorption manifested as a cutaneous or visceral deposit and as a proof of the seriousness of the septicemia.

*Occurrence.*—True metastatic abscess as a symptom of gonococcal septicemia or bacteremia is of rare appearance. It is not possible for it to arise in any other manner. The site of such abscesses may on theoretical grounds be in almost any organ but those reported in literature are chiefly in the skin, or organs opening from the skin.

**Etiology.**—The gonococcus circulating in the blood is the cause, while lowered local resistance is the predisposing factor as is found in fracture, infancy and the like.

**Symptoms.**—Added to the symptoms and signs of the original coccal infection and the secondary septicemia are the local conditions of the abscess which vary with the situation. In literature, Campbell<sup>1</sup> details a compound fracture case in a patient with weeks' gonococcal infection, followed by suppuration of the fracture due to the gonococcus, established by culture. J. Kerassoti reported a gonococcal abscess of the mastoid regions, secondary urethritis, with cure of both conditions together. F. Meyer,<sup>2</sup> of the Berlin Medical Society, presented a patient with superficial middle felon following a profuse gonococcal vaginitis. The organisms were cultured from the pus of the felon. Cassell,<sup>3</sup> in the discussion of F. Meyer's case just cited, described an exam gonococcal ophthalmia in a newborn infant with early secondary arthritis and dorsal abscess which contained a pure growth of gonococcus. Lang<sup>4</sup> has detailed a case of urethrocystitis followed by metastatic abscesses in the left metacarpal regions. Klausner and Reenstierna<sup>7</sup> fully establish the origin of their cases, Klausner an abscess of the bursa over the tuberosity of the tibia and Reenstierna one in the left upper arm.

**Diagnosis.**—A mild or severe septic state marks the history of the disease extending and otherwise complicated gonococcal urethritis shows the subjective symptoms of the sepsis followed by or accompanied by those of the abscess, respectively, such as chills or chill fever, digestive disorder, circulatory disturbance, prostration and the like, along with one or more deposits of the pus at almost any point accessible to examination, which verifies all the foregoing symptoms and adds recovery of pus by aspiration or incision. In the laboratory such a specimen must deliver the gonococcus for smear and culture alone or associated with the pyogenic organisms and the blood must be in a state of bacteremia and positive complement fixation. Treatment of the original focus of disease limits further extension of the sepsis and thereby the origin of other abscesses. Suitable surgery against the septic process itself is of value and finally incision and drainage of the abscess prove its identity and secure the specimen for the final demonstration.

**Treatment.**—Abscess itself is commonly easy to treat but the underlying absorption is difficult. The prophylaxis is the same as the underlying bacteremia and toxemia in the care of all gonococcal infections, especially severe cases and complications. Abortion of the cause of the abscesses is impossible but of the abscesses themselves can

<sup>1</sup> New York Med. Jour., February 28, 1908.

<sup>2</sup> Ann. d. mal. d. org. genito-urinaires, 1904, xxii, 516.

<sup>3</sup> Deutsch. med. Wchnschr., 1903, xxix, Society Proceedings, p. 226.

<sup>4</sup> Jahrb. d. Wien. K. K. Krankenanstalten, 1892, 1893, i, 514.

<sup>6</sup> Dermatol. Wchnschr., 1915, ix, 723.

<sup>7</sup> Arch. f. Derm. u. Syph., 1914, cxx, 870.

on the liberal painting of the affected skin with tincture of iodine or 5 per cent. carbolic acid until white coagulation slightly appears followed and combined with a 95 per cent. ethyl alcohol wet dressing or a wet dressing of 1 in 5000 bichloride of mercury or 6 per cent. aluminum acetate.

Full explanation of management is found in Chapter IX, on General Principles of Treatment, on page 483.

Physical means depend on cessation of the pus-producing process when resorption may be stimulated by judicious massage and the application of the Bier hyperemic treatment. The latter may be applied even earlier to stimulate discharge of pus and destruction of the organism. Massage is an early substitute for physical exercise. Hydrotherapy in cold often reduces pain and congestion in the abortive attempt and in heat promotes pointing of the abscess and light through its heat and actinic power—an admirable adjuvant, as is also electrotherapy when tissue massage is advisable, but only after drainage has been well established. The static brush discharge as already described under Phlebitis is the modality of most service.

The medicinal measures during the acute periods avail hardly more than in septicemia and there is special danger in serumtherapy which may be fatal through increase of the infection during the negative phase. All the treatments detailed for the convalescent of septicemia apply here.

The surgical measures are both operative and nonoperative and wet dressings and applications comprise the nonoperative means as mentioned under abortion. Operation consists in a deep linear or crucial incision into the cavity of each abscess enlarged with scissors to prevent any overhang of flaps so that the incisions are coextensive with the cavity. Swabbing each abscess with tincture of iodine or with 95 per cent. carbolic acid followed by 95 per cent. ethyl alcohol and then packing it with gauze followed by suitable dressing closes the operation. No sutures are ever used.

*Aftertreatment.*—The drains are left as long as there is discharge, decreasing them with filling of the wound and changing them to stimulating dressings, such as balsam of Peru, and associating them with applications, such as 10 per cent. silver nitrate solution, also for stimulation. All the medicinal means suggested in the aftertreatment of septicemia essentially apply.

*Cure* pathologically follows the same rule as in the provocative blood condition and symptomatically the abscess must be healed without sinus and only a node of the abscess, infiltration and the scar of the incisions left for slow resorption.

*Arthritis.*—In a certain sense arthritis might be regarded as a circulatory complication, but it is discussed as a separate subject on page 248.

#### 4. *Respiratory Complications.*

*Varieties.*—The gonococcus occurs in rhinitis and pleuritis.

**GONOCOCCAL RHINITIS.**

**Significance.**—The eyes must be protected against extension and direct inoculation.

**Occurrence.**—The nose is rarely infected. The gonococcus must be distinguished from the *Micrococcus catarrhalis* and the *Micrococcus meningitidis* common in the nose.

**Pathology.**—The lesions are the same as those of any other mucosa during gonococcal activities.

**Symptoms.**—In infants and adults are seen chiefly purulent discharge, pain, nasal dyspnea, edema, obstruction and all other evidence of severe rhinitis.

**Diagnosis.**—The essentials are proof of the source of the infection, the typical syndrome and the gonococci.

**Treatment.**—Prophylaxis resides in care of the urethritis. Rhinitis always suggests accepted management, medication and applications to destroy the gonococcus and to restore the mucosa.

**GONOCOCCAL PLEURITIS.**

**Significance and Occurrence.**—The origin is always septic during bacteremia and the proof is usually on autopsy, marking the rarity of gonococcal pleuritis.

**Etiology.**—Growth of the gonococcus on the pleura and in its cavity follows bacteremia from an active focus elsewhere.

**Pathology.**—The gonococcus is virtually the only difference between this and other purulent pleuritis.

**Symptoms.**—Pleurisy without effusion is early and later with effusion, each with its usual characteristics—all associated with the symptoms of the gonococcal focus.

**Diagnosis.**—The precedent septic gonococcal process must be defined together with the usual syndrome of pleuritis and the gonococcus in the exudate.

**Treatment.**—The gonococci and their lesions must be removed from their original site while the pleurisy is being managed along well-accepted principles.

*5. Nervous Complications.*

**Significance, Occurrence and Varieties.**—Nervous complications indicate profound absorption. They occur only during bacteremia and septicemia, accompanied by lesions in other organs. Acute forms predominate. The foci are cerebral, spinal, meningeal and peripheral.

**Etiology.**—The gonococcus, with its toxins, is absorbed.

**Diagnosis.**—A primary focus of the gonococcus in a septic case is essential. The typical cerebral syndrome and the organisms in the blood are final.

*1. Central Nervous Complications.*

**Varieties.**—Of cerebral, spinal and meningeal forms, the cerebral is the least common.



**GONOCOCCAL CEREBRITIS.**

**Occurrence.**—Obscure and rare reports often lack bacteriological proof.

**Symptoms.**—Delirium, mania, meningitis and apoplexy have been described according to the brain elements involved.

**Diagnosis.**—The essentials of proof are the lesions of origin, bacteriologically established, and the cerebral sequels.

**Treatment.**—The primary gonococcal foci belong to the urologist and the cerebral lesions to the neurologist.

**GONOCOCCAL MYELITIS.**

**Occurrence.**—The cord is more often involved than the brain.

**Etiology.**—Intoxication of the myelon with the bacteria and toxins is the cause.

**Pathology.**—Disseminated or segmentary myelitis as suppurative inflammation followed by subsidence or destruction of the nerves, cells and fibers is present. Secondary muscular, sensory, trophic and reflex nerve changes are seen.

**Symptoms.**—The characteristic stages of onset and irritation followed by subsidence or by paresis or paralysis of muscular, sensory, trophic or reflex function are seen.

**Diagnosis.**—The gonococcus must be an element in the myelitis. In differentiation the primary seat of the disease is important.

**Treatment.**—The myelitis must be referred to a nerve specialist while a urologist cures the original focus.

**GONOCOCCAL MENINGITIS.**

**Varieties.**—Cerebral, spinal and cerebrospinal are distinguished.

**Etiology.**—The meninges are attacked by gonococci circulating in the blood.

**Pathology.**—All the recognized lesions of suppurative meningitis are present through the activities of the gonococcus.

**Symptoms.**—A severe gonococcal infection is followed by septic signs and then by nervous irritation and depression.

**Diagnosis.**—The source of the gonococcal absorption and sepsis must be proved, then follows the syndrome of cerebral or spinal meningitis or both. Autopsy alone gives the final proof.

**Treatment.**—The nervous infection belongs to the general medical or neurological expert. The vaginal focus must be treated by the urologist.

*B. Peripheral Nervous Complications.*

**Occurrence.**—Obvious intoxication from chronic foci foreruns these lesions.

**Varieties.**—Neuralgia, neuritis and neuroses are the common forms.

**GONOCOCCAL NEURALGIA, NEURITIS AND NEUROSES.**

**Etiology.**—Obscure chronic absorption is the chief factor.

**Pathology.**—The lesions are functional rather than organic, so that true pathology may be absent. The nerves attacked are musculo-cutaneous, radial, median, tibial, sciatic, lumbosacral, lumbosacral and intercostal.

**Symptoms.**—Various and typical signs of each are fully described in works on neurology. Neuralgia predominates in pain and sensitiveness. Neuritis may show sensory, trophic, reflex and muscular changes. Neurosis is highly various.

**Diagnosis.**—Definite decision is difficult. Relief of the symptoms by cure of the gonococcal focus is important.

**Differential Diagnosis.**—The neurites of poisoning (chiefly metallic) infections, rheumatism, gout and wasting disease must be distinguished.

**Treatment.**—The original point of absorption must be cured by the urologist, otherwise the greatest skill of the neurologist will fail.

**6. Ocular Complications.**

**Significance.**—The eye is a peripheral nerve organ which determines the classification of gonococcal infection of it.

**Varieties.**—Exogenous, proceeding from without the eye, and endogenous or metastatic, transferred by the blood current, are the two forms.

**Etiology.**—Direct transfer of the virus may arise through instruments and the fingers of attendants upon children and the sick. A primary gonococcal focus is the source of metastases.

**GONOCOCCAL IRITIS AND CHOROIDITIS.**

**Significance and Occurrence.**—Profound eye lesions always mean gonococcal septicemia. The iris, choroid and optic nerve may be individually or collectively affected.

**Varieties.**—Primary and secondary forms are usual. Primary lesions represent deposits before a true septicemia is established. Acute courses only are seen.

**Etiology.**—Septic metastasis causes the endogenous form and direct transfer of pus the exogenous form.

**Pathology.**—In iritis there are congestions, swelling, infiltration and exudation of serum blood and pus, forming hypopyon. Choroiditis shows infiltration of the choroid and outer layers of the retina.

**Symptoms.**—Full discussion must be referred to works on diseases of the eye to which must be added the gonococcal focus and septicemia.

**Diagnosis.**—An eye specialist should be called for each case. Demonstration of the primary lesion and the absorption is easy.

**Treatment.**—The source of the gonococcus must be cured for correction of the septic state while the eye must remain under the care of an ophthalmologist.

Electrotherapy is peculiarly serviceable. The positive pole of a high-speed, multiple-plate static machine is grounded, and the negative pole is connected with a specially shaped, high-potential vacuum eye electrode. The spark-gap is a half-inch. The strength of current is one milliamperè, the duration is for twenty minutes at each sitting, and the repetition for treatment is at first twice daily and then at longer intervals, according to improvement. The results are very quick relief of pain by promotion of absorption of infiltration and exudation. There are no afterresults and the medication of the eye specialist may be applied at the same time.

### GONOCOCCAL CONJUNCTIVITIS.

**Significance.**—This disease has very great importance in children and adults owing to acute destruction of the eye unless proper treatment is instituted and followed from the outset. In any event a certain degree of damage is assured. The services of an ophthalmologist should be secured as soon as the diagnosis is settled.

**Occurrence.**—Before the work of Cr  d  , in 1881, conjunctivitis in the newborn was very common. It may be safely said that practically all blindness following conjunctivitis immediately after childbirth was due to this one cause. Likewise before the age of bacteriology, gonococcal conjunctivitis in older children from error in asepsis in institutions and homes, and in adult patients themselves from carelessness, was also a very common disease. Relatively speaking, it is now uncommon, wherever ordinary intelligence may be enlisted, both in the care of the eyes of the newborn, of utensils in institutions and of the hands of adult patients. The disease is more frequent in the homes of the poor than in institutions, owing to the frequency of uncured gonococcal lesions in that class, and their inability and ignorance in providing the means and carrying out the method of prevention and cure.

**Etiology.**—The gonococcus of Neisser is regularly the exciting agent, while the avenue of invasion or predisposing cause is in the newborn vulvovaginitis in the mother, whose discharge directly contaminates the eyelids of the baby. The onset is always within forty-eight or seventy-two hours, in *postpartum* cases. Long dry labor with its attendant traumatism, the lack of resistant epithelium and the absence of tear glands in the eye of the newborn, are all predisposing causes. All forms of urogenital discharge at any age and in both sexes should be regarded as sources of serious danger. It is in the declining stage of gonococcal disease in the adult when suffering is over and carelessness invited that infection occurs.

*Antepartum* or *congenital* cases due to progress of the gonococcus into the uterus usually after rupture of the membrane before birth have been reported. Incubation longer than four or five days is apt to indicate accidental infection after birth, such as from linen, of the mother or other children, failure of asepsis in the institution and the like.

In older children and in adults, the transfer of the organism to the eye is either through various utensils or infected fingers of attendants or the patients themselves. Nurses may readily have such fingers from the insertion of thermometers into the rectums of infected children, particularly females.

It is well to enumerate the other organisms of purulent conjunctivitis especially in young infants which, by this term, may be distinguished from gonococcal conjunctivitis. Among the cocci are pneumococcus, streptococcus and other pyococci, *Micrococcus luteus* and *Micrococcus catarrhalis*. Among the bacilli are those of Koch-Weeks, Klebs-Loeffler of diphtheria, bacillus of Morax-Axenfeld, pneumobacillus, true and false bacillus of influenza, streptobacillus and Bacillus pyocyaneus. This large variety proves the need of most careful bacteriological research in suspected cases before conclusions.

**Pathology.**—As in all other mucous membranes the gonococcus in the conjunctiva produces the typical changes in series, congestion, exfoliation, infiltration, suppuration, ulceration and the like. The great delicacy of the membrane in the newborn and even in the adult makes the entire process even more severe than in the urethra. Thus temporary lesions are comparatively rare, and do not occur unless ulceration is avoided by efficient treatment. The permanent lesions, on the contrary, are chiefly the complications and sequels which Péchin<sup>1</sup> enumerates as infection of the cornea possibly leading to ulceration, perforation, retrochoroidal hemorrhage, lesions of the iris, secondary glaucoma, leucoma, staphyloma, panophthalmia and anterior polar cataract. Thus the possibilities are extremely severe. Ulceration and cicatrization of the cornea lead to blindness.

**Symptoms.**—The disease manifests itself slightly differently in infants, adults and the aged, being much more severe in the first and the last owing to lowered resistance at the extremes of life. Periods of invasion, establishment and termination may be recognized each with its local and systemic subjective and objective symptoms. Children cannot always describe their condition which is necessarily often only objective. The period of invasion is shown in infants by dashes or spots of redness in the conjunctiva of the lids. In adults the subjective local symptoms are tickling as of foreign body, hyperemia and tendency to rub the eye, then lachrymation followed by a serous or mucoserous discharge with gonococci and with slight thickening so as to gum the lashes. The objective local symptoms are at first on the palpebral, then on the bulbar conjunctiva great redness and edema, so that the latter is even elevated above the cornea which seems to lie in a depression and later shows its bloodvessels prominently. Exfoliation of the mucosa is shown by roughness. In the subjective establishment the tickling changes to pain, heat and tension, radiating to the eyebrow, temple and forehead. Photophobia is an early and progressive symptom. The objective local signs are that the watery

<sup>1</sup> Péchin, Luys: Loc. cit., p. 243.

becomes a purulent discharge loaded with gonococci. The redness, roughness and edema become extreme so that it is difficult to open the eye, except with elevators and so that, at times, the upper eyelid overlies



FIG. 56.—Ophthalmia neonatorum. (After Haab.)



FIG. 57.—Total blindness due to perforation of the eyeball and escape of its fluid contents. (De Forest.<sup>1</sup>)

the under lid and may be more or less everted. The systemic symptoms are in all ages a febrile movement, rapid irritable pulse, anxious,

<sup>1</sup> De Forest: New York Med. Jour., May 29, and June 5, 1915.

nervous and tense state. The untreated disease is apt to run an acute severe rather than a subacute mild course. Only the most prompt efficient treatment gives hope of good result.

The termination is favorable only when treatment is extremely prompt, efficient and properly applied. Fatalities do not occur, although Politzer<sup>1</sup> describes a case in which purulent conjunctivitis was followed by meningitis, but it cannot be stated bacteriologically whether this infection was gonococcal or not. The report is, however, highly suggestive of possibilities. In modern days full recovery is more and more common, owing to early diagnosis and modern antiseptics, but even with these advantages the early involvement of the epithelium over the cornea commonly leads to more or less ulceration and later scar and defective vision. In extreme cases deformity of the eyelids themselves is seen and total destruction of the eye as an organ.

Severe cases in a few hours, overnight or in a day, may result in total destruction of the eye. Bilateral cases are somewhat more severe than unilateral, possibly due to the greater difficulty of suitable attention to both eyes. In the extremes of life, infancy and age, the bodily powers are deficient and the disease is more destructive.

**Complications.**—Complications are rare and belong to the class of absorption, such as arthritis. The preauricular lymphatic gland is often involved, as it drains the conjunctiva.

**Diagnosis.**—Any ophthalmia arising at or immediately after childbirth in the infant, or during any period of gonococcal infection in the adult demands the most careful bacteriological investigation, even in the stage before pus is developed, which is the moment of accomplishing the best early control of the case. Distinction between gonococcal conjunctivitis and purulent conjunctivitis, which is excited by the organisms given under the heading of etiology, is very necessary. The writer had a case of simple pink-eye appear during a gonococcal urethritis, having all the early features of a gonococcal conjunctivitis. The patient was immediately referred to an eye clinic where the full diagnosis and treatment were immediately given. Such cases are by no means uncommon and early neglect leads to serious results. The history, therefore, uncovers the incidence of the conjunctivitis directly after childbirth by a mother suffering from leucorrhea or even without known lesion, or its occurrence during a gonococcal urethritis in the child or adult with people who are not cleanly in the instincts or its mediate origin from the fingers and utensils of nurses and other attendants of children who have disregarded asepsis. Subjective symptoms are absent in young children, but older ones and adults may describe the rapidly progressing irritation, watery lachrymation followed by pus, pain and increasing photophobia. The objective symptoms are those of early, fiery redness, edema and exfoliation of the epithelium and pus containing the gonococcus with or without

<sup>1</sup> Jahrb. f. Kinderheilk., 1870, p. 335.

other organisms. The laboratory findings prove the bacteriological cause and should always be carried out immediately, as delay in the distinction of the disease may be costly to the patient. Treatment is not of great value in the diagnosis except that the resistance of the gonococcus to ordinary means only corroborates the clinical and bacteriological evidence. Metastatic gonococcal conjunctivitis must always be borne in mind, and is suggested chiefly by the presence of other foci of infection in other parts of the body, especially perhaps arthritis.



FIG. 58.—Gonococcal ophthalmia in the adult, showing great congestion of the conjunctiva, pericorneal injections, free purulent discharge. (Taylor.<sup>1</sup>)

**Differential Diagnosis.**—Purulent conjunctivitis may arise from a number of infections other than gonococcal, as indicated in the paragraph on etiology. The list of organisms thus present may be repeated. Among the cocci are pneumococcus, streptococcus and other pyococci, *Micrococcus luteus* and *Micrococcus catarrhalis*. Among the bacilli are those of Koch-Weeks, Klebs-Loeffler of diphtheria, Morax-Axenfeld, pneumobacillus, true and false bacillus of influenza, streptobacillus and *Bacillus pyocyaneus*. This large variety proves the need of most careful bacteriological research in suspected cases before conclusions. It is manifest that a mucous sac as small as the conjunctiva and an organ as sensitive as the eye can both react to any infection in practically the same series of symptoms in kind but

<sup>1</sup> Loc. cit.



differing in degree. Thus from the conjunctiva we have redness, swelling, exfoliation, discharge, discomfort, pain, and from the eye, irritation and photophobia, which are mild in the catarrhal and marked in the suppurative infections. Symptoms of destruction of the eye are omitted because this is a terminal sequel and the differential diagnosis must be made preferably during the incubation and certainly early in the invasion. Careful bacteriology alone will distinguish all the foregoing bacteriological causes from each other and from the gonococcus.

**Treatment.**—Promptness, consistency and persistency of treatment are the keys of the problem. Prophylaxis at childbirth consists in the method of Cr  d  , by which the eyelids of the newborn child are washed with boric water and then 1 to 2 drops of 2 per cent. nitrate of silver solution are instilled upon the conjunctiva. Reaction is controlled with normal salt or boric acid solution. If the infection appears, the hands of the child had best be restrained from rubbing the eyes, especially when only one is involved, and in adults the uninfected eye is protected with a shield made either of a piece of celluloid cut to fit brow, nose and cheek or a watch-glass of suitable size. Either is placed over the eye and secured on all sides with adhesive plaster of which the edges are fastened with flexible collodion. All dressings should be burned and attendants warned to keep their own hands scrupulously clean and to wear goggles to protect their own eyes.

Abortion of the infection is possible, if diagnosed very early, by irrigation with warm boric acid solution followed by the instillation of the silver nitrate solution twice a day and the use of 25 or 50 per cent. argyrol solution between times. Such measures should be continued several days associated with frequent examination of smears until the gonococcus is no longer present. If pus has already developed these measures will fail and may succeed only in the serous and mucous stages exactly as in urethritis.

General Treatment in Chapter IX contains all details of management on page 483.

**Curative Treatment.**—All measures must be promptly adopted and consistently followed.

Medicinal measures in the acute stage are by local administration. irrigations and washings of the conjunctival sac with cold boric acid or normal salt solution followed by the instillation of antiseptics. All exudate must be washed away as rapidly as it occurs and the 2 per cent. nitrate of silver solution should be employed night and morning and the argyrol solution at frequent intervals, with care not to induce a chemical irritation by either.

Physical measures recognize chiefly hydrotherapy in the irrigation of the conjunctiva sac with normal salt solution or boric acid water to remove the exudate, followed by the instillation of the antiseptic drops such as 2 per cent. nitrate of silver twice a day associated with argyrol 10 to 50 per cent. and in cold applications with small pieces of cotton or gauze fitting the eyeball and passed directly from a cake of ice.

Such pads should never be used a second time, so that a great number of them should be prepared. The heliotherapy applied to the affected temple, side of the head and neck is a valid and active decongestant and may be used many times daily for long periods until the skin is quite red. Its decongesting and soothing action equals that of blood-letting with leeches at the temple. The eyelashes are kept free of pus by gentle mopping. If the cornea becomes involved, iritis is often prevented and always benefited by instilling 1 per cent. atropin solution to keep the pupil dilated, at rest and without adhesions. The silver nitrate is stopped at the same time. Ulcerations of the cornea, synechiæ and deformity of the lids resulting from this disease are fully discussed in works on ophthalmology.

The surgical measures are nonoperative and operative. The non-operative steps are blood-letting with leeches, for which heliotherapy may well be substituted. The operative technic is multiple puncture of the eyelids for extreme edema and if chemosis with its dangers of pressure on the eyeball and cornea appears, the tension and swelling are relieved by dividing the ocular and palpebral mucous membranes with blunt scissors. If this does not relieve then the outer canthus may be cut to give free access to all the cavities and recesses of the membrane. Such procedures belong to the specialists in diseases of the eye.

*Aftertreatment.*—Immediate aftertreatment seeks relief of the chronic catarrh following the certainty of destroyed gonococci and respects possible dangers to the other eye for a definite period after treatment is stopped. Relief of the infection in the urethra is a definite element in the aftercare. Remote aftertreatment involves applications of the sulphate of zinc or copper to the granular eyelids, Knapp's compression operation if these stimulations fail, various operations on the cornea, iris and eyelids and even enucleation and perhaps the wearing of a glass eye in cases of various deformity or total destruction, respectively. These procedures belong to special work on the eye and are therefore omitted.

*Cure*, pathologically, aims at removal of the infection and the prevention of profound damage but often fails of full realization on account of the delicacy of the eye and the rapidity of the process. Disappearance of the gonococci is essential. The eye, symptomatically, should be serviceable or even normal and free of catarrh or deformity in the eyeball or lids, and bacteriologically without infecting organisms such as the gonococcus or its allies.

### 7. Locomotory Complications.

**Synonym.**—Gonococcal rheumatism is common, but is nondescriptive and without recognition of definite lesions.

**Significance.**—Gonococcal synovial complications denote systemic invasion. The gonococcus and its toxins have selective action on all synovial membranes, and particularly those of the locomotory system.

**Occurrence.**—Locomotor complications are the most common extragenital manifestations. They are acute, absorptive or chronic relapsing in type. Joint, tendon sheath, muscle, bursa, cartilage and periosteum may be involved. They are all focal signs of absorption usually proceeding from posterior urethral infection and its complications.

**Varieties.**—According to the tissue attacked, there are recognized arthritis, tenosynovitis, myositis, bursitis, chondritis, perichondritis and periostitis.

### **GONOCOCCAL TENOSYNOVITIS.**

**Occurrence.**—Tenosynovitis is less common than arthritis. Women (unless pregnant) suffer less than men and children. Neighboring joints are often involved. The affected sheaths are those of peronei, manual and pedal digital extensors and flexors, radial extensors, muscles of the thumb, semitendinosus and semimembranosus.

**Varieties.**—Acute, subacute and chronic are the courses of serous and suppurative exudates.

**Etiology.**—Metastatic gonococcal infection is always present.

**Symptoms.**—Those of the focus of absorption and of severe tenosynovitis are the picture.

**Diagnosis.**—Relief of the focus often proves the nature of the complication.

**Treatment.**—Recognized surgical care of the infected sheath and cure of the gonococcal focus are the elements.

### **GONOCOCCAL PERIOSTITIS, PERIOSTOSIS, MYOSITIS, BURSITIS, CHONDRITIS AND PERICHONDRITIS.**

**Occurrence and Etiology.**—All these lesions are very rare. Their source is regularly a genital focus of acute or chronic gonococcal disease.

**Clinical Features.**—In no respect except early severity, followed by chronicity and the presence of the focus of absorption, do the gonococcal forms differ from other types.

**Diagnosis.**—Gonococcal infection and absorption must be proved. The organism may occur at the sites of complication.

**Treatment.**—Cure of the sexual lesion is the first step. The other details are good management, protection, hydrotherapy, baking, electrotherapy, heliotherapy, Bier's hyperemia and suitable medications.

### **GONOCOCCAL ARTHRITIS.**

**Occurrence.**—Involvement of the joints is the most frequent locomotory and, therefore, extragenital complication of gonococcal disease. In frequency about 2 per cent. of all cases suffer from it and a much higher percentage in the complicated cases, especially those in men with seminal vesiculitis and in women with salpingitis. It commonly makes its appearance during the first or second week of severe absorp-

**tive acute or of exacerbations of chronic cases and their complications. The posterior urethra is the particular starting-point. The joints are invaded in descending frequency as follows: Knee, ankle, wrist, fingers, toes, shoulder, hip and temporomaxillary. The same joints on both sides, or various joints on one side or different sides of the body may be invaded.**



**FIG. 59.**—Author's case of short streptococcus arthritis of the elbow. About eight years after infection arthritis developed in one ankle and the small joints of the hand in addition to both elbows. The ankle is shown in Fig. 60. About 25 per cent. limitation of motion was present. The x-ray picture shows the thickening and deposits in the synoviae. Careful bacteriologic search revealed the streptococcus and not the gonococcus and the focus of absorption was in the seminal vesicles and prostate, but the wife of the patient seemed to have escaped any infection.

**Varieties.**—Acute and subacute, progressive chronic and relapsing chronic are the clinical forms as to course, while those as to site of the lesion are arthrosynovitis, arthritis and osteoarthritis, in which respectively the synovia alone, the joint as a whole and the joint with the bone surfaces and cartilages are involved.

**Etiology.**—Arthritis is never primary but always secondary to gonococcal conditions elsewhere, which in the urethra is anterior occasionally, but posterior usually, either acute or chronic, especially of the relapsing and complicated forms. The predisposing factors are age and sex, which are of little importance although males suffer more frequently than females. Heredity, predisposition to articular lesions and little resistance to absorptive effects of any infection are important. Lessened articular resistance through previous attacks of other forms of rheumatism, gout, injury, exposure, exertion, and

occupation which leads to overuse of certain members are elemental influence. The writer had a case of gonococcal arthritis of the hand in a jewelry-polisher, whose fingers were necessarily almost always overused. Previous attacks of gonococcal arthritis are the potent predisposition. The exciting cause is regularly the gonococcus and its toxins, alone or associated with other pyogenic organisms deposited and developing in the joint and its structures. The source of the organisms, as already stated, is commonly a posterior urethritis, rarely acute but usually relapsing or chronic with complications.



FIG. 60.—Author's case of short streptococcus arthritis of the ankle. About 10 years after infection arthritis developed in both elbows and the small joints of the hand in addition to the ankle. One elbow is shown in Fig. 59. About 25 per cent limitation of motion was present. The x-ray picture shows the thickened synovial deposits in the synoviae. Careful bacteriologic search revealed the short streptococcus and not the gonococcus and the focus of absorption was in the seminal vesicles and prostate, but the wife of the patient seemed to have escaped any infection.

In the last in males the most fertile is seminal vesiculitis, probably due to the small size, functional activity, vascular complicated mucosa, retracted and occluded outlet and actively absorbing surface. For duplicate reasons in females the tube is the chief source of joint conditions.

Cases in which the gonococcal infection is pure and those in which it is associated with other organisms are seen. Indeed, some authorities believe that joint involvement cannot occur except through the action of associated pyogenic organisms, especially the *Streptococcus pyogenes*.

The joint lesions may ensue upon any other complication of gonorrhea or dental infection with the gonococcus. This is particularly true

unctivitis in children followed by arthritis. Sometimes the ringing of sounds through strictures which are still infective will open an avenue for absorption and arthritis. The writer has seen one case, where polyarthritis ensued upon premature passage of a child before the bacteriology of the condition was known.

**Pathology.**—The gonococcus with its allies is deposited and grows in the joint, as the essence of the process, and therein makes changes in the synovia, joint tissues and even bone substance in the peculiar and characteristic way. Exudate is apt to appear, sterile



Fig. 61.—Author's case of gonococcal dorsolumbar spondylarthritis. Absence of clear spaces indicates bony ankylosis and loss of lime salts in the bodies of the vertebrae. Defined by faint shadows, indicates atrophy of long disuse. The sacroiliac region of this patient is shown in Fig. 62.

ly, later containing the gonococci and finally again sterile. They are frequently found, however, by sedimenting, centrifuging and filtering, and no diagnosis is final without these steps. In joint effusions the gonococcal complement fixation test of Schwartz is of great value, probably because the disease is one of absorption. The organisms have been found in the scrapings of joints, previously negative to aspiration. Thus negative fluid is not absolute proof of absence of the organism in the joint.

Temporary lesions occur only in very mild cases, including arthralgia and arthrosynovitis, which apparently rarely reach the stage of exuda-

tion in any great degree. Permanent lesions, on the other hand, much more common and in the milder degrees result in fine fibril adhesions, but in the greater degrees in dense, fibrous and even bony ankylosis after destruction of the cartilages. The associated lesions are the secondary changes of disuse in the muscles which become flabby, paretic and even atrophic, and the antecedent lesions of gonococcus from which the joint involvement proceeded.

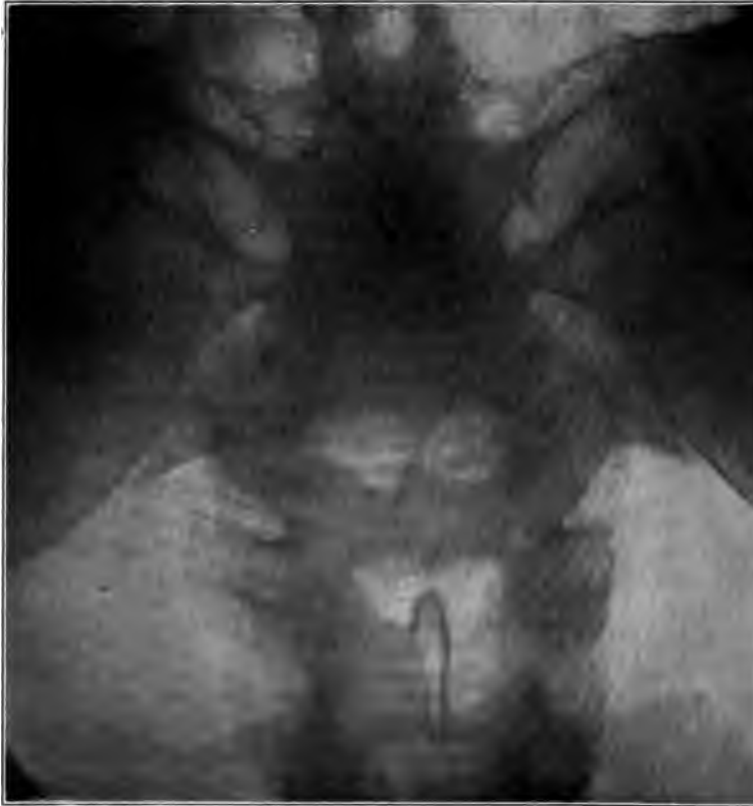


FIG. 62.—Author's case of gonococcal sacroiliac spondylarthritis. Loss of shadow of lime salts indicates atrophy of disuse and loss of cartilage space proves bony sacroiliac ankylosis. The lumbar region of this patient is shown in Fig. 61.

The pathological varieties are arthralgia, synovitis, arthritis, osteoarthritis and polyarthritis. Arthralgia is really a neuralgia of the joint and has no described lesions. It may be neuritic or mildly synovitic and naturally leads to full recovery. Synovitis or arthrosynovitis is practically hydroarthrosis, in which the synovia alone is attacked followed by puffy swelling, copious exudate usually of serum or serum and pus, never of pus alone. The knee is the usual victim with delayed full recovery. Arthritis involves all the elements of the joints more or less, with rather typical purulent exudate followed by fibrous ankylosis.



sions, few or many, slight or dense and disabling. Osteoarthritis adds involvement and destruction of the cartilages covering the bones, and bony ankylosis as a sequel. Polyarthritis is this condition in the fingers or toes, and is frequently called polyarthritis deformans. Commonly the distal and middle joints of the phalanges are invaded, less frequently the metacarpophalangeal or metatarsophalangeal articulations. Great deformity and ankylosis are the rule. Mixed infection is the accepted fact in the last two forms.

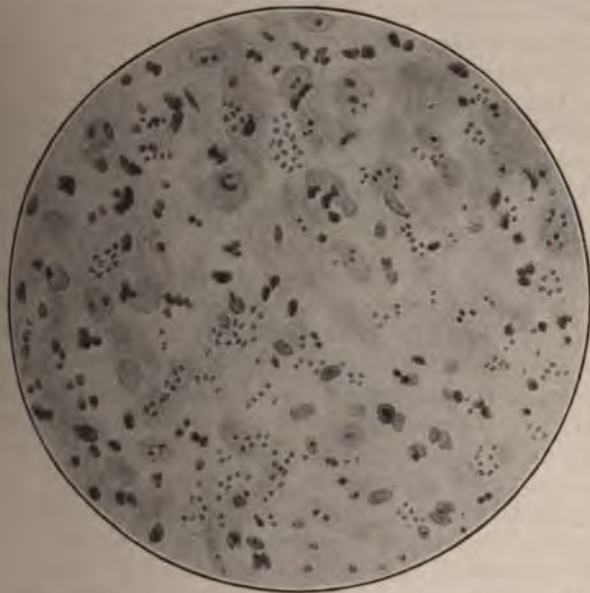


FIG. 63.—Gonococcal arthritis. Infiltrated synovial membrane, with numerous endocellular gonococci and not a few extracellular gonococci in the connective-tissue stroma. (Finger.<sup>1</sup>)

Lovett<sup>2</sup> notes the following forms of joint lesions: (1) Arthralgia without definite joint lesions; (2) acute serous synovitis with much periarticular swelling; (3) acute fibrinous or plastic synovitis, with little effusion; (4) chronic serous or purulent synovitis; (5) periarticular involvement, such as bursitis and tenosynovitis. Whatever the classification, all forms may merge one into the other, without great demarkation.

Spondylarthritis is not an uncommon manifestation of gonococcal disease of the joints. Figs. 61 and 62 show the x-ray photographs of the author's case of spondylarthritis in whom, during a very severe attack of gonococcal urethritis, the lower dorsal and entire lumbar spine and sacroiliac joints became involved intensely and finally ankylosed. Tuberculosis was eliminated by every known examina-

<sup>1</sup> Die Geschlechts-Krankheiten, 1908.

<sup>2</sup> Keen's Surgery, 1907, p. 304.

tion and test and syphilis by the absence of a Wassermann reaction and all other clinical signs. The x-ray report by Dr. Byron C. Darling is as follows:

"Spondylarthritis or spondylitis deformans: A late stage of spondylarthritis in counterdistinction from hypertrophic osteoarthritis, which latter is characterized by spurs or lipping of the bodies of the vertebræ.

"1. The poor definition and lack of contrast in the roentgenogram is due to the loss of lime salts, the atrophy of disease in the vertebræ, and is characteristic of the condition. The cartilage spaces between the posterior articular facets of all the lumbar vertebræ are absent, indicating bony ankylosis.

"2. The sacroiliac region shows obliteration of the cartilage space between the sacrum and the ilium, with complete bony fusion and the same loss of lime salts from atrophy of disuse."

**Symptoms.**—Local and systemic, subjective and objective, manifestations occur. The local subjective symptoms are pain, heat, swelling and disability. The pain is prominent mostly in the morning, when, after a night's sleep, the joints are disturbed by motion. It is relatively least in arthralgia and synovitis, and greatest in arthritis and subvarieties. It may be sharp and cutting or intense and incapacitating, leading to spasm of the muscles in fixation of the joints. In the old chronic cases the pain may be discomfort aroused to acute violence, sudden exertion or exposure. Heat is marked and proportional with the severity of the attack, and its recency, declining with the age of the case.

Swelling is absent in arthralgia, but appears with synovitis sometimes to a great degree and is always present in the acute or relapsing stages of chronic arthritis. It is represented by exudate into the cavity of the joint and congestion and edema of the joint substance and annexa. In recent cases tension and fluctuation or "dance of the patella" and in old cases thickening around the joint are seen.

Disability is due to pain, swelling, adhesion and muscular spasm. In arthralgia the sharp neuralgic pains in neuropathic individuals are much complained of as disabling and sometimes become a veritable neurosis of incapacity. In hydroarthrosis the accumulation may mechanically prevent motion, while in arthritis the fibrinous adhesions physically limit it and their pain on tension reflexly checks it. Bony ankylosis speaks for itself as a source of disability. Muscular spasm is seen during the acute stages as a reflex protection of the invaded joint, alike in this as in all other articular conditions, inflammatory or traumatic.

The subjective systemic symptoms are those of absorption. The patient has malaise, nervous depression and often irritability. Complaint of the atrophy of disuse and of the attendant reflexes and spasms is often made. In arthralgia these symptoms are less manifest and of a higher grade in synovitis and still more severe in arthrosynovitis, arthritis, osteoarthritis and polyarthritis. Such a rule would l

pected because these lesions usually indicate absorption in ascending counts and increasing activity of the local complication. The objective systemic symptoms simply verify the foregoing statement by the patient, and it will be found that many of them run a low grade of fever and that a large majority of the more severe cases have a positive gonococcal complement fixation test.

The local objective symptoms vary with the stages of the disease. In the acute period there are redness, swelling and edema of the skin and joint, reflex fixation, tenderness and pain, and in the chronic periods there are infiltration, boggiess, crepitation, adhesions and ankylosis. These symptoms vary in degree and relation with the severity of the infection. They are least in arthralgia and greatest in arthritis, osteoarthritis and polyarthritis. Atrophy of the muscles with depression or exaggeration of reflexes about the affected joint is a late manifestation of severe cases. When spondylarthritis occurs the disability and other attendant symptoms are most marked. The original urethritis and its complications belong to the local objective symptoms.

The termination is favorable as to life unless the general infection is so severe as to lead to septicemia and death, in which the arthritis becomes, therefore, only a small element. It is favorable or unfavorable as to the joint in accordance with the severity of the lesion. Full recovery follows arthralgia, except in the rare victims of neurosis or of joints irritable to exposure and exertion. Arthrosynovitis follows the same rule, but with greater tendency to nonresistant joints. In arthritis and its extensions into osteoarthritis and polyarthritis deformans the permanent damage is great and there is hardly any limit to the secondary lameness. Many patients are seen who for life must endure the loss of half-function in a number of joints. The writer had a man in whom 50 per cent. of one elbow, 25 per cent. of the other elbow, 10 per cent. of one shoulder, 25 per cent. of one ankle and about the same amount of one hand were lost in function for life.

As in other forms of arthritis, relapses are very common, frequently under slight or even unknown cause.

**Diagnosis.**—The presence of urogenital gonococcal foci or complications must always be searched for and studied. As already pointed out, gonococci have been found in the blood of many victims of posterior urethritis and its sequels. It is, on the other hand, not necessary for septicemia or bacteremia to be present for arthritis and its analogues to arise. Careful bacteriological research must always be exercised toward gonococcal lesions, and also toward fluid aspirated from the affected joints, tendon sheaths and the like, as many authorities believe it is the associate organisms, notably the streptococcus, which render the arthritis possible. It is a safe rule to say that few or no locomotory complications should be recognized as indubitably gonococcal, unless the organism has been recovered from the antecedent foci, and from the affected joints after repeated search and combined with a positive gonococcal fixation test. The history,

therefore, involves either hyperacute or long-continued active urethritis, both with their appropriate complications and other toms of absorption. The subjective symptoms pass from those urethritis over into those of the systemic invasion with deposited active disease in the joints, chiefly pain, spasm, disability, fixation "creaking." The objective signs must detect the focus from which the disease proceeds, its presence in the joint by heat, redness, swelling, fluid, crepitation and muscular rigidity, and if necessary its purulent nature is shown by withdrawing the fluid for the laboratory. A laboratory investigation simply recognizes the morphology and characters of the recovered organism. Examination of the blood by the gonococcal complement fixation test is almost always positive. Treatment aids the diagnosis in the point that very rapid subsidence of the synovial inflammation upon surgical or other treatment of the focus of gonococcal infection proves the connection between the lesions.

Keyes<sup>1</sup> gives the following table of distinction between gonorrhea and gonococcal urethritis.

TABLE OF DIFFERENTIAL DIAGNOSIS BETWEEN GONOCOCCAL A  
SIMPLE RHEUMATISM.

GONOCOCCAL RHEUMATISM.	SIMPLE RHEUMATISM.
1. Cause: gonorrhea. No influence of cold in the production of the rheumatism.	1. No etiological relation with state of the urethra. Habitual cold, inheritance, rheumatic diathesis.
2. Very rarely observed in women.	2. Common in the female, all less frequent in the male.
3. Nonfebrile, or much less so than simple rheumatism. Even in acute cases reaction never attains the habitual intensity of rheumatic fever.	3. Reactional phenomena much more intense and prolonged than in gonorrheal rheumatism.
4. Symptoms habitually limited to a small number of joints. The affection never becomes general to the same extent as does simple rheumatism.	4. Symptoms usually involve a number of the articulations; sometimes all of them.
5. Less movable than simple rheumatism, going from one joint to another less quickly. No delitescence; no real jumping from one joint to another.	5. Symptoms: movable, with fluxions; rapid delitescence, jumping from one joint to another.
6. Local pains generally moderate, always less than in simple rheumatism; sometimes remarkably indolent.	6. Pains always rather intense, sometimes excessive, disappearing less than those of gonorrheal rheumatism.
7. Frequently a tendency to hydrarthrosis following the acute fluxion.	7. Little or no tendency to consecutive hydrarthrosis.
8. No sweating.	8. Abundant sweats, constituting a symptom almost essential to the disease.
9. Urine not modified.	9. Urine specially modified.
10. Blood not furnishing a marked buffy coat.	10. Blood forming a firm, compact clot with buffy coat.
11. Cardiac complications exceptional.	11. Cardiac complications frequent.
12. Frequent coincidence with a special ophthalmia, inflammation of the synovial sheaths of the tendons, inflammation of the bursa, etc. The latter localities may be exclusively implicated.	12. Acute rheumatism does not involve the eye; the bursae escape, as do the sheaths of the tendons.
13. Relapse in the course of successive gonorrheas very frequent.	13. Relapse frequent, but always independent of the state of the urethra.

<sup>1</sup> Genito-urinary Diseases, 1905, p. 55.



The author would add four other distinctions:

14. Gonococci in urethral discharge or seminal vesicular secretions, sometimes in the urine in males and in the vulvo-vaginal glands, cul-de-sac of the vagina, cervix uteri and also urine of women.

15. Aspiration of joint frequently reveals the gonococcus.

16. Gonococcal complement fixation test positive.

17. Condition of tonsils or teeth not a factor.

14. No gonococci.

15. No gonococci in fluid of joint.

16. Gonococcal complement fixation test absent.

17. Tonsils or teeth often source of infection.

#### **Treatment of Arthritis, Periarthritis, Myositis, Bursitis and Chondritis.**—

In these important conditions the prophylaxis is preëminently proper and active attention to the urethritis and its complications, notably in the prostate and the seminal vesicles, which should receive regular examinations during a posterior urethritis for detection for the earliest onset of disease. Cautious instrumentation, avoidance of all traumatism and selection of conservative methods of treatment of urethritis and these complications all belong to prevention of systemic invasion and secondary synovial complications, because any injury of the mucosa during active infection is a wide-open portal of absorption. Abortion is nil but active and proper treatment of a joint or tendon sheath at the first sign may practically prevent extension.

*Curative Treatment.*—Curative treatment respects the findings of both pathology and symptomatology. The pathological indications must confine the inflammation to the serous and delimit it from the purulent type and in addition prevent, if possible, more than a true synovitis in contrast with panarthritis or pantesynovitis with secondary adhesions and sometimes ankylosis. In short, the lesions are restricted to the temporary and excluded from the permanent type.

The symptomatic indications maintain and relieve the mild as contrasted with the severe symptoms and decrease the pain, spasm and hydrarthrosis and the systemic absorption and symptoms which denote continued activity of the antecedent focus. Prompt resolution is stimulated instead of delayed recovery and above all the symptoms and infection of the primary focus must be relieved after the methods already described under each head.

The management secures the benefit of cleanliness, asepsis and antiseptics in good hygiene and the great essential is rest in bed to abate the inflammation as a whole and splinting of the parts to soothe the pain, spasm and local inflammation. Exercise is forbidden until the process is terminated and, as in ordinary rheumatism and gout, selected diet and drink are necessary although of comparatively less value. Nursing at least during the acute period had best be special and even later when massage and other physical means are useful.

The physical measures are among the most important and selected according to stage of the disease. Massage is for the chronic period and keeps the muscles in health, prevents their atony and even atrophy as a substitute for voluntary exercise. Various ointments may be applied

during the massage, of which salicylic acid (2 to 4 per cent.), ichthylol and iodoform are examples. Passive motion of the joints as part of the massage beginning with slight and adding increasing degrees as necessary and in severe cases mechanical treatment with the various vibratory and manipulating machines is excellent. Hydrotherapy employs moist heat or cold. Hot fomentations, poultices and douches are comforting and counterirritant and antiseptic wet dressings may be combined with them. Cold succeeds when heat may fail and may be employed with the ice-bag or the cold-water coil. In the recovery period when absorption and elimination are indicated hot, general Turkish baths are of value. Baking the affected member in a well designed and operated hot-air apparatus is very efficient and the hyperemic method applied for at least thirty minutes two or three times a day is a prized adjuvant. Strapping for support and uniform pressure is in the later stages comforting and strengthening.

The heliotherapy consists in applying a 500 c. p. lamp to the affected joints and their annexa for from fifteen to thirty minutes several times a day as a decongestant and counterirritant. So strong a lamp must never be at rest but always in motion, waving back and forth over the skin. Intense redness without blister is sought.

The electrotherapy may be the hot-coil applied to the affected joints for the indications of thermic action or preferably diathermy is applied daily in the manner previously described under septicemia. In stiffened joints the indirect static spark is generously and persistently applied at first daily, then three times a week.

The medicinal measures treat the antecedent point of gonococcal absorption along recognized and already described lines and by systematic application any and all standard antirheumatic medicines may be administered—always up to physiologic action and without disturbing the general nutrition of the patient. While relatively of less value in gonococcal arthritis than in other forms perseverance, full dosage and changes and combinations in selection often produce results. The indications are catharsis with salines, diaphoresis with aspirin, urinary antiseptics with boric acid, biborate of soda, benzoic acid, benzoate of soda, or hexamethylenamin, alteration with iodide of potash and mercuric cury, and support with quinine, strychnine and iron. The best antirheumatics are oil of wintergreen, colchicum, salicylate of soda and salicylic acid combined with bicarbonate of soda. Alkaline mineral waters, such as French Vichy, freely taken are very good.

By local application during the fomentations and bakings counterirritation may be employed, with oil of wintergreen, turpentine, guaiacol and eucalyptus. Iodine may be painted on or administered in ointment. Other salves are 20 to 50 per cent. ichthylol and iodoform. Blisters from the actual cautery, strong iodine and cantharides, however, when open by strong salves may be used but incur the risk of cellulitis through the break in the skin. Intense counterirritation may be employed by "stripping" the joint with the actual cautery without blisters. Irritation of bursæ with a few drops of pure carbolic acid has been tried.

sacs not related to joints, such as the bursæ beneath the tendon of Achilles.

Serumtherapy appears to give its greatest success in synovial complications and its methods are detailed in the following paragraphs. Autogenous or heterogeneous serums and bacterins may be tried with favor toward the former unless they fail and among the latter toward the mixed or associated bacterins, such as Van Cott's. The secret of success is regular periods of administration, slowly ascending doses, no negative phase or other severe reaction and rather large doses toward the end of the course with proper respites between courses. The treatment may be laid down according to the chart described in later pages of this chapter. The chronic and subacute periods are better than the acute on account of the likelihood of negative phase with increased symptoms. Bacterins are better than serums.

The surgical measures are nonoperative and operative. Support of the part with splints and casts introduced nonoperative procedures associated with wet dressings—antiseptic, such as aluminum acetate, or sedative, such as lead and opium wash. Leeches will decongest. Operative technic is based on incision, evacuation, cleansing and suture of joint, tendon sheath or bursæ with the tendency of opening the part as little as possible on the principle of Scriba,<sup>1</sup> whose operation consists of entering the joint with two small trochars and cannulæ at opposite sides to permit through and through irrigation first with a cleansing fluid followed by hot bichloride of mercury 1 to 5000 until all pus is removed. The wounds by the trochars are stitched up and a dressing and splint applied. The knee is the best joint for this treatment. Resection of the joint and removal of the tendon sheath are reserved for the oldest and most marked cases.

J. Scriba gives a series of cases, of which one was suppuration of the knee with gonorrhea of four weeks' standing. This was not a mere coincidence as the patient suffered from "acute articular rheumatism." Double incision on each side of the patella and irrigation with 5 per cent. phenol were carried out. This procedure was years before Neisser demonstrated the gonococcus. This case seems to be one of the first if not the first application of double opening and irrigation of the knee-joint in gonococcal arthritis. The credit of this procedure to Keyes, as is made in Watson and Cunningham's work, *Diseases and Surgery of the Genito-urinary System*, 1908, p. 72, is stated by E. L. Keyes, Jr., in a personal communication to the author to be an error and the method to be one which he himself has never employed.

*Aftertreatment.*—Immediate aftertreatment demands cure of the urethritis. Its relief may antedate that of the synovial complications. Restoration of the synovial membrane and elements of the joint to the nearest possible normal condition is the standard. Gradual increase in passive motion followed by mild and the increasing voluntary exercise. Adhesions should be gradually broken up by this

<sup>1</sup> Ueber die Gonarthrotomie und ihre Indikationen, etc., Berl. klin. Wehnschr., 1877, xiv, 640.



process or under either an effort to continue normal metabolism continued with proper diet, habits and drinks. Alkaline mineral waters are of great value. Operative cases receive standard and appropriate care and every patient should avoid exposure to cold, wet, strain, injury and overexertion, because synovial membranes once infected are very susceptible to relapse or attacks of simple inflammation from such causes.

The remote aftertreatment comprises general common sense concerning the health, strength and resistance of the patient and also all absolute avoidance of fresh gonococcal infection because such incident would almost be sure to be followed by absorption and renewed arthritis. The so-called rheumatic diathesis should receive attention.

*Cure.*—Cure, pathologically, in mild cases is probably absolute in severe infection restricted and limited according to essential destruction of elements of joint, tendon sheath or bursa. Symptomatically there should be no pain, fluid, crepitation or adhesions and full or nearly full function and bacteriologically the gonococcus must be absent in antecedent urethral focus and in the synovia.

## COMPLICATIONS OF NONGONOCOCCAL ACUTE URETHRITIS

**Classification.**—There is a close similarity between these complications and those of gonococcal anterior and posterior urethritis. This is, therefore, a urogenital group in which the lesions affect the organs of the sexual and the urinary systems, so that both the genital and urinary forms are recognized. In most of the nongonococcal infections, however, the urinary organs are much less frequently affected, either by the initial lesion or by its complications. The chief exception is the suppurative conditions. A systemic group is also recognized in which the organs of the extraurogenital systems are involved. The much less severe character of the nongonococcal manifestations makes such complications extremely rare; but it is well to bear these facts in mind. The rarity of all these conditions is the reason for their very brief treatment in this work.

**Varieties.**—Varieties as given in the clinical section are traumatic, catarrhal, diathetic, eruptive, pyogenic, syphilitic and chancroidal. Each of these is important but the general principle of treatment is closely that of gonococcal complications that such principle is assumed in the following paragraphs and only differences and distinctions noted.

**Significance.**—Significance, in general, is chiefly minor except in the syphilitic because this is essentially a systemic disease, and in the chancroidal because it often leads to operation on the glands of the genital system and pyogenic because it may be as vicious as the gonococcal complications. The pyogenic, therefore, closely resembles the gonococcal in severity and character while catarrhal does so in type but less in intensity, although its duration and intractability often suggest gonococcus. Traumatic, diathetic and eruptive, may be nonbacterial.

exist in urethritis alone and often have no complications, in which nature catarrhal lesions share. Traumatic inflammation of the urethra may induce epididymoöorchitis and cystitis or make anterior disease posterior. As previously stated in the clinical section, minor complications invade the foreskin alone or the mucosa of the urethra alone, whereas major complications compromise the sexual glands and the organs of the urinary system or the general system.

Minor complications are therefore classified: (1) Phimosis; (2) paraphimosis; (3) balanitis; (4) posthitis; (5) balanoposthitis, which may occur in any of the nongonococcal forms of infection; (6) folliculitis seen chiefly in the catarrhal and pyogenic; (7) lymphangitis; (8) lymphadenitis developing rarely in the catarrhal, more frequently in the pyogenic and invariably in the syphilitic and chancroidal lesions. Their treatment, in general, is the same as that for the gonococcal complications modified to meet particular conditions. The removal of the cause is essential in traumatic, so that solutions too hot or too concentrated and instruments too large, rusty or imperfect, and their application too violent are instantly stopped. Care of the health and attention to resistance are required in catarrhal, diathetic and eruptive forms. Catarrhs elsewhere in the body are often keys of the problem and attacks of glycosuria and uric acid poisoning should be abated as part of the treatment of the complications. Surgical dressings are required in chancroidal and syphilitic manifestations, to which may be added incision of the glands in the groin for abscess and active antiphilithic systemic treatment. Pyogenic complications require the full management and all the measures prescribed for gonococcal, because except for the infecting organisms there is no definite distinction between the two.

Major complications in the sexual forms include these classes: Cowperitis, prostatitis, seminal vesiculitis, epididymoöorchitis and epididymitis and in the urinary forms urethrocystitis, cystitis, urethritis, ureteritis and pyelonephritis.

The Cowperites are reserved for the catarrhal rarely and the pyogenic very commonly, and prostatitis is occasional in traumatic, more usual in catarrhal and still more common in the pyogenic. Seminal vesiculitis is produced only by the pyogenic, to which is added epididymoöorchitis, which may also be syphilitic. The urinary forms are seen in ascending order of frequency in the pyogenic, catarrhal and syphilitic complications. Careful distinction must be drawn between the catarrhs, which are the terminal stage of other complications and the catarrhs which originating as such in the urethra extend into the ureters or upward along the urinary tract.

Treatment in general means that all these complications deviate but little from the methods and measures set down for those of gonococcal origin on the ground that the pyogenic germs are the prevailing infection. In particular the surgery of these cases is in no wise different. Catarrhal forms require combat of this peculiar weakness by sustaining the health and restoring low-grade bodily strength and syphilis

requires active measures with mercury, iodides, the newer arsenical preparations, general support and hygiene.

*Cure*, pathologically, in full restoration of the parts may be possible in the milder lesions, such as traumatic, catarrhal, diathetic and eruptive, but it is not possible in more destructive pyogenic, syphilitic and chancroidal disease. Symptomatically, however, relief from suffering and symptoms is usually attained except in the more profound pyogenic disease and bacteriological eradications of organisms and relief from the positive signs in the blood test are the measures of good results.

## CHAPTER IV.

### CHRONIC URETHRITIS.

**General Clinical Features.—Definition and General Principles.**—Chronic inflammation of the urethra at any point and due to any cause may properly be described as chronic urethritis, a condition in which the lesions are either more or less stationary with relapses, or slowly progressive with exacerbations. It is rather well to fix this general conception in the mind and then to distinguish each important kind as to symptoms, diagnosis and treatment.

**Varieties.**—As already stated the clinical forms are stationary with relapses and progressive with exacerbation. Cure is possible in each type, but usually the mucosa is permanently changed in various ways and degrees which are sequels and will be so described in this work.

As to location and extension, there are recognized anterior and posterior, anteroposterior or general and localized, that is, confined to definite single or multiple points either the anterior or the posterior portions of the canal or both.

As to cause, nonbacterial and bacterial, of which the latter is practically the only form of clinical importance, unless one regards the relapses of catarrhal urethritis seen in many patients for a few days after instrumentation as examples of chronic disease.

The varieties of nonbacterial chronic urethritis, according to excitants, are the same as those seen in acute manifestations, but rest on a chronic diathesis, by which comparatively simple factors may lead to long-continued lesions: (1) Traumatisms, thermal from too hot or too cold irrigations, chemical from too concentrated applications, mechanical from too rough introduction or defective forms and kinds of instrument; (2) medicinal, from drugs irritant after internal administration, such as balsams, cantharides, alcohol and turpentine and after eating such vegetables as asparagus, rhubarb, tomatoes, strawberries and the like; (3) physical, from the use of instruments too hot or too cold, with rough surfaces and faulty introduction.

Traumatism may involve any healthy mucosa, but is most potent in the unhealthy cases and rests on the use of rough, rusty or ragged instruments as well as unskilled and forceful manipulation. The offense of an indwelling catheter is a familiar traumatism; and in this class belong masturbation and sexual excitement without coitus. Caution should always be exercised to pass smooth instruments and with gentleness, never to use applications of extremes of temperature or concentration, and never to repeat treatment at intervals too short for a recovery period.

Of bacterial urethritis, nongonococcal and gonococcal varieties are seen, of which the former have the same general but far more mild features than the latter, so that the latter may be regarded as furnishing the type for all the others in the clinical manifestation. Chronic suppurative nongonococcal urethritis may duplicate the ravages of the gonococcus, but is rare and needs no separate discussion, except to note that the pyogenic organisms alone are present.

The varieties of bacterial chronic urethritis, according to the exciting organism, duplicate those given in the list of causes of bacterial nongonococcal acute urethritis, but may be repeated here: *Micrococcus catarrhalis* in true catarrhal forms, the *Treponema pallidum* in syphilitic types, the bacillus of Ducrey in chancroidal invasions, and the ordinary pyogenic organisms in simple pus cases, *Bacillus coli communis* being often seen. Bacteria are doubtless a factor in the majority of cases, hence the importance of bacterial investigation.

### 1. GONOCOCCAL CHRONIC URETHRITIS.

**Significance.**—As in acute urethritis, gonococcal infection will be taken as the type and its two varieties of anterior and posterior will be considered together.

#### Anterior and Posterior Gonococcal Chronic Urethritis.

**Occurrence and Significance.**—The general characters of gonococcal infection in the urethra render the tendency to persistence of the process both active and great. It may be safely said that few cases are seen without more or less protracted subacute or terminal stages, although true chronic disease may not ensue. This fact is true in both anterior, posterior and anteroposterior infections. It is probable that chronicity is most common in the posterior urethra, although in older writers this lesion was more or less doubted.

The significance of truly chronic gonococcal infection in both sexes is that many of its lesions provoke little or no subjective attention, invite indifference and neglect and thus lead to infection of the opposite sex in the marriage-bed. There is practically no difference between the dangers which the one sex may offer the other in these circumstances.

**Etiology.**—The fact that gonococcal infection of the mucosa is not a superficial catarrh, but a vicious, penetrating, infiltrating suppuration, is now fully established through its characters of exfoliation, infiltration, ulceration, purulence, complications and chronic tendencies. This pathogenic nature of the process is the essential or exciting cause. Among the predisposing factors are the ignorance and indiscretion of patients and errors in diagnosis and treatment. The victims are negligent and indifferent in their management, heedless of warning as to the character of the disease and sometimes even vicious in the chances taken of infecting the innocent. Their occupation is often

an offense to the inflammation. One of the worst cases the writer has ever seen was in a railroad brakeman whose occupation aided the disease in wide extension. Indiscretions are also common during the most treacherous and uncertain period—that of the decline. Excesses in alcohol, diet and sexual relations are not uncommon. Thus from the patient little or no coöperation is obtained.

Errors in diagnosis, which are commonly those of failure to search for the gonococcus by smear and culture and for absorption by the complement fixation test, are largely responsible for many uncured cases, as treatment is prematurely discontinued even by the physician. Unduly frequent treatment by patient and physician, with concentrated solutions, improper instruments and the like, tends to augment the natural tendency of the disease to penetrate, become chronic and complicated, by repeatedly adding to the infection the element of thermic, chemical or physical trauma, with secondary catarrhal inflammation.

A most important element is poor resistance of the patient to all ordinary diseases which, instead of ending quickly and fully, are apt to be protracted into long periods. Questions concerning his general resisting powers should always be asked the patient as an element in prognosis.

A minute subdivision of causes of so important a condition as chronic urethritis cannot well be inclusive and exclusive, because factors in some instances are predisposing and systemic, but in others exciting and local. As a rule the same factors are at work in both the nongonococcal and gonococcal disease in producing a tendency to chronicity. The predisposing systemic factors are, as in acute urethritis, low vitality, semi-invalidism and acute or chronic alcoholism. Conditions producing hyperacid, alkaline or crystalline urine, such as gout, rheumatism, diabetes and lithiasis, constituting the so-called diathetic urethritis, are also important in the presence of gonococcal invasion. Tuberculosis is a factor in depreciating the health and strength, as also are unhealthful occupations.

Predisposing local factors are a mucosa vulnerable by previous attacks, even of noninfective urethritis or by injury or any other element tending to leave permanent damage locally. Periurethral disease, as hypertrophy of the prostate in the male and in the female uterine displacement, laceration and deformity, are poor grounds of cure in acute gonococcal infection and directly invite the chronic forms. A more full discussion of the influence of all these factors is given in the Chapter on Acute Urethritis on page 19.

The bacteriological causes are familiar, being chiefly the gonococcus and secondarily its usual allies, as fully discussed under Gonococcal Acute Urethritis and its Etiology on page 21.

**Pathology.**—Gonococcal chronic urethritis is never primary but always secondary to one or more acute infections. In general pathogenesis, like the acute manifestations of this infection, the anterior and posterior forms differ from each other chiefly in respect to their

permanent lesions. The essence of the process is gonococcal infection of the mucosa, with or without complicating deposits, in the glands and organs immediately associated with the urethra. The inflammation is of two forms: (1) chronic, persistent and stationary; and (2) chronic and slowly progressive. Both may be subject to exacerbations and are at the basis either of suppurative and catarrhal inflammations, more or less associated in the marked cases, or catarrhal alone after the suppuration has subsided in the milder cases. There is therefore, cell proliferation in the deeper layers and desquamation of the cylindrical epithelium in the superficial layers, with a tendency toward recovery and substitution of squamous for cylindrical cells. The regeneration may never be complete, so that a kind of variable balance is present between the loss and the restoration of the lining cells. This same type of process is present whether the mucosa is of the urethra, its mucous glands and the prostate in the male or the vagina, uterus and cervix in the female. The gonococci become buried in the depths of the epithelium along the urethra, in the mucous crypts and in the glands, where they may persist for years with great inconvenience to the patient, but with danger of infection of the opposite sex.

The tissues involved, therefore, are the mucosa in all its layers, the submucosa and not infrequently tissues beyond this structure, and in one or more of the foregoing processes. To these should be added the small mucous glands, both simple and compound, and such other lying structures as the glands of Cowper, the prostate, the testis and the vasa deferentia and the like.

The temporary lesions are found only in the catarrhal forms, from which full recovery may be had, whether associated with the chronic suppurative foci without recovery or essentially catarrhal after suppuration has ceased. They are typified by stratification, infiltration, desquamation, superficial ulceration and catarrhal exudate. The stages are stratification of the cylindrical epithelium up to many layers, even a half-dozen wherever the mucosa occurs along the urethra and in its glands. Then the other processes occur and indicate the permanent changes in the same distribution. The desquamation and ulceration become deeper, pavement epithelium replaces the upper layer of the cylindrical cells, the infiltration augments and a certain amount of dryness and elasticity occurs, resembling the skin and possessing decreased permeative and absorptive powers, thus rendering local treatment less efficient. Such changes of cylindrical to pavement cells probably always occurs in fully established severe disease, with true chronic termination. The mucous glands at such a focus take on exaggerated activity in compensation for dryness and thus lead to chronic uninfected catarrhal discharge which may never be corrected, and had, in fact, best be left untreated as it is beneficial. The deeper ulcers and infiltrations may result in cicatrices and thickenings, followed by retraction, with deformity of the course and caliber of the urethra or in exuberant granulation.



and polypi. By exactly the same steps the mucosal glands are altered, some are destroyed and others hypertrophied with chronic discharge. The loss of mucosa followed by cicatrix and infiltration, and then by deformity in course and caliber, is the basis of organic stricture of the urethra.

The associated lesions are chiefly those induced by the organisms of complicating infections, as stated in the discussion of Acute Urethritis on page 82, or those of the diathesis promoting the chronic disease. The complicating lesions are those of the organism involved in this process, too numerous for full discussion when one bears in mind that the pathogenesis is identical wherever the gonococcus and its allies penetrate.

In the pathology of the anterior urethra special glandular structures require attention and study.

It is well to note rather fully the changes in the glands of Morgagni and Littre which occur in two stages, activity and destruction, and the lesions of the periurethral structures. The crypts of Morgagni during the stage of activity enlarge, hypertrophy and show patulous ducts, and may not greatly progress beyond these points; but in the stage of destruction they suffer chronic suppuration, occlusion and cyst formation and may even lead to periurethral abscess and fistulae. They may disappear by atrophy, sclerosis and retraction. The glands of Littre may suffer similarly by the prominent processes of the gonococcal infection, that is to say, substitution, compression and occlusion. The stage of substitution is as in the urethral epithelium, that of pavement for cylindrical cells, with secondary alteration of the glandular secretion, and even disappearance of the cell and its replacement by round-cell infiltration. The stage of compression is due to intense cellular infiltration, with retraction, contraction, pressure and slow destruction of the gland. The stage of occlusion shows the ducts blocked, the contents retained to form simple cysts or suppurating foci, which may burst into the urethra or the cavity of the affected organ or into the periurethral tissues, thus forming by persistence or repetition of the process sinuses, abscesses and fistulae. Suppurating occluded glands, after rupture and discharge, are clinically the most dangerous as sources of infection. The gonococcus lurks in the depths of the glands, in the lowered focal resistance from which for anatomical reasons it is often impossible to drive it, and from which it may proceed to a fresh outbreak through any cause favoring congestion of the urethra, such as excesses in food, alcohol and sexual relation.

The periurethral tissues may be attacked, especially when many acute infections have been grafted on each other without cure of any or when improper instrumentation has opened up the mucosa for penetration into the outlying structures. Thus the corpus spongiosum urethrae is infiltrated with round cells, which are finally replaced by fibrous tissue which contracts, retracts and deforms as stricture, or the corpus is invaded by abscess and fistula.

The foregoing data apply both to anterior and posterior gonococcal chronic urethritis, but a few features of the latter should receive individual note.

In the posterior urethra the processes are infiltration, proliferation and desquamation, followed by repair and substitution. The infection has a great tendency to reach the subepithelial layers and to penetrate the glands which are essentially connected with the posterior urethra.

In the prostatic urethra the ejaculatory ducts in the colliculus are by the tissue changes often compressed, distorted and strictured, or contrariwise, patulous and inflamed, with chronic discharge, inviting or suggesting spermatorrhea. The prostatic ducts in the sinuses of the urethra are also either infiltrated and destroyed or chronically inflamed with plugs of mucus or pus. The prostatic acini or glands show changes duplicate to those of the urethra and its glands: (1) The lining epithelium may be predominately affected, desquamated and finally atrophied, resulting in a secretion which is stringy, abundant, opaque and filled with degenerated epithelial and pus cells; or (2) suppuration may be the chief factor and determine the character of the discharge. Thus two forms of chronic prostatitis are produced.

In the membranous portion between the layers of the triangular ligament there are no glands of importance, but the infiltration, followed by the inelasticity and acted on by the muscles, not infrequently produces more or less splits, tears and ulcers, which may be the basis of stricture.

*Granulomata and Papillomata.*—The urethral mucosa, as that in all other parts of the body, when subjected to chronic inflammation shows hypertrophy of various elements into caruncles, granulomata, papillomata and polypi. The granulomata are granulations, as already stated, of exuberant character on unhealed ulcers. The papillomata and the polypi may be, in a certain sense, later sequels of the chronic inflammation, probably as in the nose either the direct result of the inflammation, with more or less retention of secretions, or of changes about strictures, especially in the proximal aspect where retention is very abundant. These lesions have been studied by Burckhardt,<sup>1</sup> who divides them into caruncles, condylomata, papillomata and mucous and glandular polypi.

Caruncles occur most frequently in females at the meatus of the urethra, have a fiery, raspberry-like appearance, a sessile, rather defined attachment and a tendency to bleed on contact, through great vascularity. Their microscopic elements are numerous dilated blood-vessels in a mass of pavement epithelium in layers. To contact with urine, the finger or instruments in examination and the penis in coitus they are usually excruciatingly painful.

Granulomata occur more frequently in males in the posterior urethra, particularly the prostatic portion, have the appearance of a cock's comb and the resemblance to the condylomata acuminata seen exter-

<sup>1</sup> Handbuch der Urologie, 1906, iii, 267.

ally under the foreskin and about the vulva. Their attachment is usually pedunculated, with height and width greater than the base, or less frequently sessile, with the base equal to or greater than the other dimensions. Their vascularity is rather sparing. The microscopic elements are a few bloodvessels in a more or less fibrous delicate stroma surrounded by a rather thick pavement-epithelium covering in layers.

Papillomata also occur more frequently in males and in the posterior urethra. In appearance they resemble the foregoing granulomata, adding the presence of definite papillæ. Their attachment is also pedunculated or sessile. Under the microscope the papillæ are unmistakable, with a thick pavement epithelial covering and rich bloodvessels extending through the pedicle and its various papillæ.

*Mucous polypi and glandular polypi* occur in both sexes and most frequently around the neck of the bladder, although they are found at almost any point of the urethra. In appearance they are cystic and translucent, somewhat resembling a white grape, and in attachment usually pedunculated, although the earlier developments may be sessile. In microscopic elements they are probably inclusion processes, with a loose soft-tissue stroma and few bloodvessels, covered with a stratified pavement epithelium containing numerous glands.

**Symptoms in General.**—In accordance with whether the disease is of the anterior or the posterior urethra the symptoms will vary and should be individually discussed. The term "anterior urethra," as adopted by urologists, means the urethra distal to the triangular ligament, while "posterior urethra" denotes the canal proximal to this structure. The symptoms are subjective and objective, local and systemic. In the nature of things subjective and systemic symptoms are relatively much less than objective and local, inasmuch as the elements of discomfort and the like have largely disappeared from the subjective local conditions and inasmuch as that of absorption is in the vast majority of cases without complications has also ceased and with it the subjective systemic signs. Unlike acute urethritis, chronic cannot be described as possessed of periods of incubation, invasion, establishment and termination. On the other hand, the acute disease, simply without definite termination, passes into the chronic type which, as previously stated, may have periods of quiescent persistence, of progressing exacerbations and finally termination in a lifelong catarrh or one or several of the more important sequels. The whole progress of posterior chronic urethritis is usually more or less marked by complications. We therefore find great decrease or even disappearance of the chief local symptoms of acute urethritis which were stated as discomfort, pain, pollakiuria, hemorrhage, exulate and chordée. The terminal modifications of one or more of these symptoms may, however, persist until cure or during any exacerbation the process reappear more or less in its entirety as an acute process.

**Anterior Chronic Urethritis.—Symptoms.**—The prevailing symptom is a slight persistent discharge manifesting itself in four ways, each

constituting a type of case more or less distinctly. The term discharge should be most carefully defined, as any abnormal exudate from the urethral walls, fluid and copious in all acute and in some chronic manifestations, but viscid and scanty in the majority of chronic cases. Thus the term means an exudate whether it is free pus or mucopus in the early periods, or watery moisture or gummy moisture, or a thick drop at the meatus, and finally merely shreds in the urine. In other words, it is any departure from the normal urine due to infection and characterized by the presence of such urethral exudate and elements when compared with their absence in healthy urine. It is well to have patients understand this view of discharge in order to prevent them from ceasing treatment when the free copious stage is gone.

In anterior chronic urethritis discharge may show itself, as stated, in four ways:

1. A drop or drops of greenish-white or yellowish pus, thick in consistency, appears at the meatus in the morning on rising or during the day at stated intervals between urinations. It seems to possess little tendency to close the lips of the meatus, lies free in the cavity of the urethra, is highly infectious, and usually denotes recent chronic lesions or complications or both.

2. A drop of mucopus or pus appearing chiefly in the morning, with much tendency to gum the lips of the outlet together. This is a transitional condition, as a rule, between the more free pus of the first class and the watery mucous condition of the next form.

3. A watery discharge, chiefly mucus, most abundant on stripping the urethra and without much tendency to gum the lips. It is apt to be present after urination, but must be carefully distinguished from the drop of urine sometimes late in appearing after this act. It is also to be distinguished from the mucous moisture induced by sexual excitement and sometimes by pressure upon the prostate of constipated movements. It must, in other words, be of strictly post-inflammatory urethral origin.

4. Shreds alone in the urine without subjective and often without objective sign at the meatus, but constituting, nevertheless, discharge in the sense designated above.

Exactly as the sputum in tuberculosis carries the *Bacillus tuberculosis*, any and all these forms of discharge are commonly the means of carrying the gonococcus, and should, therefore, in every case, be carefully searched for the organism before adopting a policy of treatment or uttering a prognosis. The patients should receive very careful instructions as to the infectiousness of all these forms of urethral discharge.

It is probable that a persistent single drop is commonly the sign of anterior chronic urethritis, for the reasons that so small an exudate from the posterior urethra cannot during the night gravitate forward past the triangular ligament, the pocket of the bulb, and finally the angle where the penile urethra folds itself over the scrotum. If the

charge in drops is more copious it may come from either the anterior or the posterior or the anteroposterior urethra. Careful physical examination including proper urinary specimens will indicate and retroscopy decide. The influence of the anatomy of the bulb on urethral discharge should be recognized.

The bulb of the anterior urethra may often be the chief point of chronic disease, owing to its anatomical conditions and variations. It may be deep or shallow, long or short, with many or few, simple or complex folds of its mucosa over the bulbocavernosus muscle, so that in the urethroscope it resembles a urinary bladder in miniature imperfectly dilated. Its mucous crypts and glands are numerous and with the ducts of Cowper's glands, if infected, add to the difficulty. Discharge may pocket in the bulb and scarcely show at the meatus during the day if scanty, but otherwise if more copious, and moreover, diurnal urination every two or three hours flushes out the urethra so that frequently the discharge cannot accumulate and appear.

The genesis of the morning drop is, therefore, that during the hours of sleep the discharge accumulates, gravitates forward to the meatus, where in the fossa navicularis and behind the apposed lips of the meatus it is retained and dried into a small scab comprising that minute quantity of it which appears in the cleft of the meatus. The fold of the penile urethra at the scrotum tends to determine that most of the discharge, unless copious, seen at the meatus is from the anterior urethra, but such a distinction is not safe, except in the presence of one of the multiple glass tests, of which, in the opinion of the writer, none is better than the five-glass test of Wolbarst, which the writer carries out in a special manner and adapts to cases of anterior and posterior chronic urethritis without complications in the prostate or seminal vesicles, because such complications require as far as possible separation of discharge from the prostate and the vesicles from each other as three separate specimens. Such distinction is afforded by the seven-glass test of the author, which is fully described in Chapter VIII on General Principles of Diagnosis on page 455, and need not be repeated here. The steps of the author's technic of the Wolbarst five-glass test are as follows:

The meatus is washed and a No. 12 French rubber or lisle-thread catheter is passed to the bulb of the urethra and stopped at the triangular ligament. Experience shows how to recognize this point by slight resistance to the catheter. With a hand syringe 150 c.c. of hot normal salt solution are flushed through the urethra from behind forward into a sterilized glass which is known as Glass I, or the Anterior Urethral Glass. Massage of the urethra before introducing the catheter loosens adherent shreds and makes the irrigation more efficient.

The urethra is now gently massaged from the bulb forward and the same step repeated, which gives Glass II or the Control Anterior Urethral Glass. The purpose of the massage is to dislodge discharge adherent to the urethra but not washed off by the first test. If the disease is in the anterior urethra alone, practically all its products

will be in Glass I and very few in Glass II, and they will conform with each other more or less definitely in kind and condition. If the control anterior urethral glass contains much exudate, another washing of the anterior urethra may be given in order to insure against error and this glass may be mixed with Glass II or held as Glass II-a. Such an extra glass is of great service in completing the diagnosis of the anterior urethra.

The patient, who should be instructed to hold his urine before the test for at least five hours, with the double purpose of permitting plenty of discharge to accumulate in the urethra, and of urine in the bladder, now passes one glass of urine. This is known as Glass III, or the Posterior Urethral Glass, as it will necessarily contain exudate from the posterior urethra. Glasses I, II, III will show rather conclusively that the disease is anterior, posterior or both in its situation. Furthermore, the differences in the character of the discharge in Glass III, when compared with its predecessors, are diagnostic and should be noted. The shreds of the posterior urethra are apt to be long, large and lumpy, while those of the posterior urethra are shorter, smaller and filamentous.

A small (No. 16 Fr.) catheter is now passed into the bladder with great gentleness and thus Glass IV, or the Bladder Glass, is obtained, and if clear will show that the bladder, ureters and kidneys are not involved, but if purulent will indicate the reverse possibility and the necessity for exploration of the urinary as well as the sexual organs. A small soft catheter and great gentleness are advisable in order to eliminate any great danger of traumatism or pressure which might produce the sudden discharge of the glands into the urethra.

Massage of the prostate and seminal vesicles is now performed in vigorous but judicious fashion, and then the patient empties his bladder into one or more glasses, thus producing Glass V, or the Massage Glass, having in it the products of infection in the organs named. If on arrival the patient has not much urine in his bladder, while the catheter is in place for Glass IV, warm sterile normal salt solution should be passed into the bladder so as to give artificial means of securing the massage specimen. It will be noted that the Massage Glass contains a mixture of the exudate from the prostate and the right and left seminal vesicles. If purulent material or detritus is found in this glass it is almost impossible to tell whether it comes from the prostate and both vesicles in association or from only one or from any two of these three organs. The seven-glass test of the author largely removes this difficulty by giving the contents of the prostate in Glass V and those of the right and left seminal vesicles in Glass VI and Glass VII, as fully described in the subject of diagnosis.

As a preventive against infection it is well to give urinary antiseptics for a day or two before and after such an investigation.

The original Thompson two-glass test is not sufficient for a distinction between anterior and posterior chronic urethritis—a fact which necessitates the adoption of the Wolbarst or other multiple-glass test.

as previously discussed. After study of the results of multiple-glass tests the course of the case may be readily followed by the two-glass method with regard to the amount of pus and the number, character and density of the filaments, combined with frequent microscopic investigation of the latter. At any moment the five-glass test may be repeated in settlement of any question of doubt, but always with the aid of posterior and anterior urethroscopy.

It must not be forgotten that chronic discharge in the anterior urethra is often due to infection of the mucous crypts throughout the canal, and of Cowper's glands in the bulb. Follicular chronic urethritis and chronic cowperitis are really complications of anterior chronic urethritis, exactly as their acute lesions are complications of anterior acute disease, and will therefore be treated under that heading.

**Diagnosis.**—This is determined on the factors fully discussed in Chapter VIII on General Principles of Diagnosis on page 428.

The history shows the acute attack with severe and prolonged symptoms and sometimes improper and violent treatment. These are followed by the symptoms of the characteristic persistent drop containing pus, watery moisture, gumminess or a thick mass crusting at the meatus and the physical examination verifies the existence of the drop and studies the characteristics of the shreds in the urine. In the Thompson two-glass test in mild cases the first glass alone may show pus or shreds but in severe cases these elements are in both glasses. For this reason the author's seven-glass test is to be preferred in that it distinguishes the contents of the anterior urethra from those of the posterior urethra and from those of the annexa. In anterior chronic urethritis the Anterior Urethral Glass will contain the contents of the canal and the Control Glass little or nothing. All other glasses are negative. The laboratory recognizes the gonococcus in the drop or shreds and the treatment verifies the other findings.

**Treatment.**—Before the treatment of gonococcal chronic urethritis may be instituted, certain general principles must be laid down and understood. They apply to the subject as a whole independently of whether or not the disease is in the anterior urethra or posterior urethra in its chief lesions.

The preventive and abortive treatment are selfevidently possible only in the proper management and gentle treatment of every case in prevention with strict coöperation on the part of the patient. It is well known that severe acute infections invariably have a chronic stage which is increased in intensity and duration by wrong treatment. Complicated cases are rather essentially chronic in their termination as suitably detailed in Chapter V. Patients who debauch in food, drink and sexuality during treatment invite and induce chronic lesions as well as reinfections grafted on nearly cured conditions. Any infection which has persisted for about four months may be regarded as chronic. Abortive measures in the exact sense do not exist for the posterior urethra.



*Curative Treatment.*—Intelligent application of suitable measures cannot be carried out without just knowledge of the needs of each case as embodied in the indication.

Methods of treatment are, as before, two: (1) The conservative or expectant, and (2) the irrigation, both of whose main features in technic are the following, varying with anterior and posterior urethral involvement.

Management is the same for both methods of treatment of each portion of the canal and will not be again noted. Coöperation and obedience by the patient are essential. The tendency of the patient to depreciation and discouragement indicates hygiene in fresh air and all effort to avoid nervous unrest and indigestion with secondary phosphaturia. Rest in the sexual sense forbids intercourse during regular treatment and restricts indulgence for a period after treatment has ceased, in order to avoid the congestion which excites inflammation and relapse. Indirect sexual excitement is very undesirable. Care similar to that in chordée will avoid seminal emissions. Bodily rest permits exercise without exhaustion or congestion of the parts but these restrictions are less definite than in acute disease. No exercise with vibration or great disturbance is advisable and the moderate forms, such as walking, are best. Hygiene must secure absence from the cause of catarrhal inflammation. Therefore alcohol and improper diet are interdicted. Regular habits of life and exercise avoid dissipation of the general health, strength and resistance. Patients with known dyscrasie should receive attention for them. Diet and drinks should be moderate and normal, of the nonirritating and nonconstipating types. No alcohol or highly spiced stimulating mixtures are allowed.

There are, therefore, required relief of the chronic urethral discharge, control of the urinary disturbance, quiescence of sexual disorder and prevention of complications and sequels. One sees three general classes of cases: (1) Intermittent discharge, which is absent during the use of hand injections and restrained habits of life, but present during cessation of home treatment and indulgence in improprieties in alcohol, food and sexual relations; (2) continuous discharge, which slowly improves under treatment and usually occurs with anteroposterior lesions; (3) shreds which may be large or small, long or short, light or heavy and contain chiefly pus or little pus mingled with mucus and detritus, or practically pure mucus with or without much epithelia. A careful distinction of the bacteriology and source of all three forms of exudate is necessary and readily performed with the aid of the author's seven-glass test as noted under diagnosis.

The physical measures include massage, hydrotherapy and electrotherapy. Massage is advisable only several weeks after active symptoms and is of little avail unless performed with an instrument *in situ*, such as a soft, lead-core dilator, a straight or standard urethral sound or preferably a Bangs syringe sound, because the massage and instillation may be combined at the one sitting. Its object is to



FIG. 64.—Passing a straight sound. "Gravitation" is the only step. The penis is held vertically in the left hand behind the glans while the lubricated instrument is allowed to fall of its own weight as far as the bulb with only support in the vertical position by the right hand of the urologist. (Original.)



FIG. 65.—Massage of chronic folliculitis. The left hand supports the urethra on the stretch, over the straight sound, which reaches the bulb. The right hand massages the urethra and its follicles along the instrument. (Original.)

stimulate erosions, ulcerations and granulations, to dissipate the erosions and to evacuate mucous crypts—all with gentleness and without secondary reaction and as preliminary of the instillation as alternate with it every five to seven days. Progressive benefit must follow this treatment as well as other measures or be abandoned. The instrument—dilator, straight or standard sound, or Bangs's syringe sound—is passed to the bulb of the urethra ascertained with the finger on the perineum. Gravity is the only force in passing these instruments. The urethra is held on the stretch and the massage is gently performed along its course upon the shaft of the instrument. No pain or unfavorable reaction should occur but only stimulation of the indolent mucosa. Massage of the urethra may also be performed



FIG. 66.—Catheter instillation, supine posture. The Wolbarst basin is placed, the penis draped, the catheter passed and the instillation administered while the forceps holds the catheter under gauze against displacement and spatter. (Original.)

with a bougie-à-boule—always the flexible, never the rigid type of instrument—which is passed into the canal and repeatedly, rapidly but gently manipulated back and forth from meatus to bulb. If size must not overstretch the canal.

Hydrotherapy is of great value in allaying irritation, especially of overtreatment—instrumental, chemical, thermal or electrical. Heat or cold, according to tolerance and response, may be applied to the penis externally best in the form of baths in a large mug or to the urethra internally preferably by means of the syringe-and-catheter irrigations, as these are safest and gentlest. A straight urethral sound chilled in ice-water may be passed into the urethra and left there for five to ten minutes, every five to seven days, associated with other

asures, if found beneficial. Hydrotherapy, except through its heat and cold in irrigations and instillations, is not of great value. In the severe inflammation, hot sitting baths for twenty to thirty minutes until the skin is red, followed by immediate rest in bed, are good, but must be repeated at least night and morning. Hot or cold rectal irrigations through the double-current instrument of Kemp, or with two rubber rectal tubes passed, one for several inches into the bowel and the other just within the sphincter beside it, give relief. Normal salt solution is best, and is hot or cold, according to preference and tolerance of the patient and results.

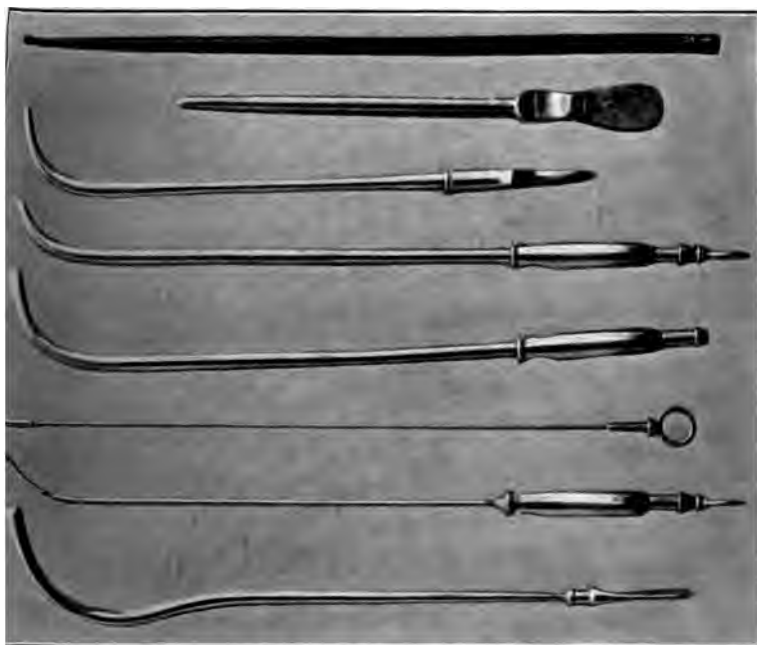


FIG. 67.—Various types of urethral sound. From above downward are the olive point, lead-core, woven, lisle-thread dilator; the straight anterior urethral sound; the Setwood double-taper standard sound; the author's short beak double-taper irrigating sound with obturator in the canal; the author's standard beak double-taper irrigating sound with the obturator below it; the author's short beak tunnelled and grooved irrigating sound with the obturator *in situ* and the standard blunt point Benique sound. (Original.)

The heliotherapy fulfils the same functions as hot-water treatment and decongests the parts. It is applied with the standard therapeutic lamp two or three times a day for half-hour sittings until the skin is distinctly redder, as with a poultice, and the comfort of the patient promoted. It is of more service in deep-seated posterior urethritis and its complications, notably prostatitis and seminal vesiculitis, under which heading it is more fully discussed. The medicinal supplies zinc chloride and copper sulphate solutions from 2 to 5 per cent.

The electrotherapy is either local or systemic. Local is applied through the urethra or the rectum for germicidal, and restorative effects, and systemic treatment to the box



FIG. 68.—Portable therapeutic lamp, efficient, convenient and serviceable of parabolic mirror and 60 c.p. lamp.

for its stimulating action. The forms of current and the for developing and applying them advised by expert electricists are the following, bearing in mind that much electrical

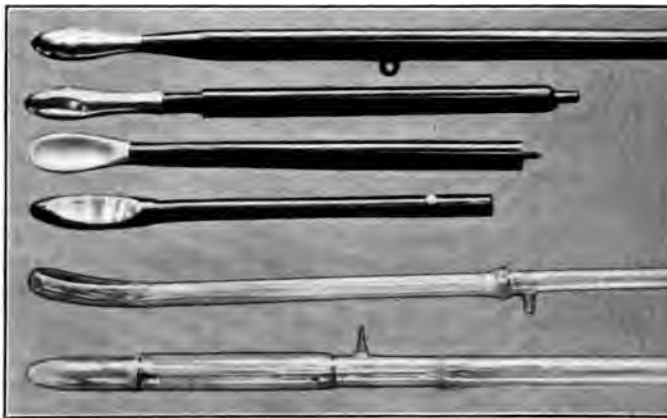


FIG. 69.—Metal and glass rectal electrodes. From above downward: tipped hard rubber handle electrodes, respectively called elongated olive rectal electrode, elongated olive with flat face, seminal vesicular electrode, spoon-shaped rectal electrode, hard rubber with metal face prostatic electrode. Then come the x-ray vacuum high-tension glass prostatic electrode and the cone point of the same type.

on the market is so inefficient as to be toys. Failure with rests with the defects of apparatus and with the inexperienced operator.

The equipment comprises machines and electrodes with accessories and medicinal supplies. The machines are of five types, developing galvanic, faradic, sinusoidal, static and diathermic (true high-frequency current of d'Arsonval) currents. Electrodes are designed for the anterior and posterior urethra and the rectum. The anterior urethral instruments are of metal or glass. The metal type must be properly constructed and fully insulated, zinc or copper tipped, as shown in Fig. 70, and paragraphs on Electrolysis of Stricture. The glass type are fully insulated, high-vacuum (for localizing effect) instruments, as shown in Fig. 69. Posterior urethral electrodes are also of metal or glass. The metal forms are preferred and are curved instruments, with metal tips 1 to 2½ inches long, of zinc, copper, aluminum or silver. The glass type must also be curved, and are shown in Fig. 69. Rectal electrodes are made of metal or glass and the

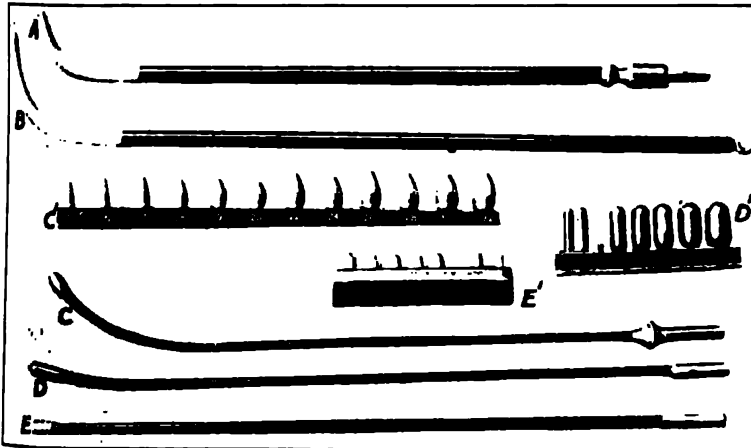


FIG. 70.—A and B, short and long curve sounds; C, long curve bougie-à-boule and *C'*, conical points for the same; D, semicurve bougie-à-boule and *D'*, long cylindrical points for it; E, straight bougie-à-boule and *E'*, short cylindrical points for the same.

former are by choice the elongated olive metal-tip instrument or the attenuated olive (spoon-shaped) metal-tip electrode or the elongated olive hard-rubber instrument with a metal face. Glass is made up into the vacuum, fully insulated electrode, with flattened olive tip and exhausted to the x-ray vacuum degree or into the same type of instrument with a conical tip. Of the two terminals used, one is the active electrode, which may be attached to either the positive or the negative pole, according to indications, and the other is the indifferent electrode, most advantageously made of a gauze or sponge covered and 5 by 8 inches. To ensure good contact it is moistened with warm water.

The selection of case is very important. Acute urethritis contraindicates electrotherapy until the subacute and declining stages are initiated, except perhaps diathermic measures ~~initiated~~ later. Chronic

manifestations invite this treatment, which is independent of idiosyncrasy. Chronic urethritis without infection and with the ordinary lesions present, such as erosions, ulcerations and soft infiltration requires the cataphoresis of galvanism. Chronic urethritis with infection, nongonococcal or gonococcal, and any of the foregoing sequelae indicates cataphoresis supplemented with the high-potential vacuum electrodes.

Diathermy is a newer development of applying the true high-frequency (d'Arsonval) current locally for raising the temperature of the organs by closely wrapping them with malleable metal electrodes, because imperfect contact produces sparks and blisters. The final results of diathermy in acute cases are still *sub judice*, but the subject should be mentioned here. General depression of health in indigestion, nervousness and imperfect elimination indicates stimulating measures, as discussed under systemic application below.

The purposes are, therefore, germicidal, penetration of medication, astringency and tissue massage, and each requires particular application through combination of machine, current and electrode.

The local application is urethral or rectal or both. The direct or galvanic current from the street mains or from a large number of batteries (both with proper controlling device and a reliable voltmeter and ammeter), is used in the anterior urethra with the metal-tipped electrodes described. By cataphoresis it deposits in the tissues oxychlorid of the metal tips employed so that the electrode is mildly consumed. This action is both germicidal and powerfully astringent. The electrode from the positive pole is passed into the urethra up to the affected points and the indifferent negative electrode is fixed on the abdomen or the back low down. The amount of current is 3 to 5 milliampères and no more. Any metal astringent previously named under equipment may be soaked into several layers of cotton or gauze wrapped about the metal tip, but if iodine is selected the electrode must have a carbon tip and the negative pole must be within the urethra. The cataphoresis produces deep penetration. The iodine is dissolved in water from 1 in 10 to 1 in 4 parts and the application persists for five to ten minutes and is repeated every five days. Intense actinic or germicidal and mild roentgen-ray effects are produced by the insulated high-vacuum electrodes of glass energized from the negative side of a high-speed static machine, while the positive side is grounded.

The tube is applied at the affected points of the urethra in turn, and intensity is measured by a spark gap of from  $\frac{1}{2}$  to 1 inch and 0.5 to 1 milliampère of current on a reliable meter in series, with the negative side of the machine. Two to five minutes are the limit of duration and one visit every five days is the frequency, with longer intervals as improvement occurs, but without change in the intensity and duration of the treatments. The results should never be painful and of great importance. There is no aftertreatment.

The systemic application, on the same or different days as the local



treatment, will benefit the digestive, nervous and eliminating functions. The digestive system, for poor assimilation and constipation, requires the combined galvanic and faradic sinusoidal current applied with a large sponge electrode over the abdomen and another between the shoulders. The interruptions of the faradic current must be thirty to the second and *no more*, in strict correspondence with normal muscular fibrillation, and the sine wave must be *absolutely* synchronous with the heart impulse in order to aid and not impede circulation. Treatments continue for from ten to twenty minutes, every other day or two days, and always short of weariness. The intensity of the current should not cause pain or discomfort, and must leave the patient feeling stimulated and not exhausted. Cutaneous and renal elimination are increased by the d'Arsonval high-frequency current, employed by the autocondensation method. For the details of this procedure the reader is referred to recent publications by Snow,<sup>1</sup> Sinclair Tousey,<sup>2</sup> de Kraft,<sup>3</sup> Titus<sup>4</sup> and Steele<sup>5</sup> because they are too minute and extensive for inclusion here.

The nervous system is relaxed and relieved of tension by the static wave current up to toleration, and comfort applied to the spine for twenty minutes every day for three days, and then every two or three days following the indications of improvement. Under this treatment the patient should leave rested and restored and not excited or wearied. The electrode is always attached to the positive pole in these systemic treatments. The circulation is influenced along with the various other systems as just described either directly or indirectly, and needs no further comment.

Medicinal measures are of least value by internal administration. Digestants, good hygiene, hematinics and neurotonics all aid the general depression and absorption, while variations in the blennorrhetics, urinary antiseptics and urinary diluents have their own, but after all little, value. Nothing to irritate either the urethral mucosa or the sexual centers through the urine should be given. Sedatives are called for by sexual hyperesthesia. The drugs are much the same as those employed in the acute stages, but act mostly as corrigents of reaction after local treatment and as preventives of relapse. The alkalis dilute and neutralize the urine and avoid irritation of the mucous membrane. They are the alkaline mineral waters and the various preparations of soda and potash. The balsams and oils stimulate the mucous membrane and improve its secretion in the indolent catarrhs. Urinary antiseptics prevent the transit of the infection from the urethra into the bladder and should always be used when the

<sup>1</sup> Jour. of Advanced Therap., June, 1909; Med. Rec., December 16, 1911; Ibid., November 6, 1915.

<sup>2</sup> New York Med. Jour., May 22, 1909; New York State Jour. Med., June, 1911.

<sup>3</sup> New York Med. Jour., February 8, 1913; 23d Annual Meeting of the American Electro Therapeutic Association, September 2, 3 and 4, 1913; and the same, Jour. of Advanced Therap., October, 1914, and the same, Am. Jour. Electrotherap. and Radiol., January and February, 1916.

<sup>4</sup> New York State Jour. Med., July, 1912.

<sup>5</sup> Med. Rec., March 11, 1916, p. 459.

existence of the gonococci is known or suspected during instrumentation which penetrates the bladder.

Serumtherapy is available only in complicated cases or profound infections with absorption. The selection of the proper case and the application of this method to it are discussed in Chapters VIII and IX under Serumdiagnosis and Serumtherapy on pages 475 and 512.

Local administration consists of (1) hand injections, (2) irrigations (3) retrojections, (4) instillations and (5) applications. Mild hot astringents, as hand injections, usually alternating with weak antiseptics, such as the newer silver salts, argyrol 3 to 5 per cent., and protargol 0.25 to 0.5 per cent., or potassium permanganate 1 in 800 and silver nitrate 1 in 10,000, are used.

As a rule, home treatment by the patient with injections is stopped except in the cases having continuous discharge proceeding from the anterior urethra, as demonstrated by the author's seven-glass test. Astringents are preferred unless infection is present, when antiseptics are required. Both are used weak and not oftener than twice a day.

Irrigations with the catheter and syringe are more valuable than hand injections and should be carried out as detailed in anterior acute urethritis, with a frequency of once or even twice a day of astringent and antiseptics alternating, or of both combined, in very weak ascending strengths of nitrate of silver. After urination by the patient a reflux catheter is passed to the bulb or to the locality of subjective and objective sensitiveness to urine and palpation and the washing is performed. The solutions must be hot to tolerance, the pressure gentle, and there must be no unfavorable reaction, no pain, spasm or tenesmus.

Retrojections are more serviceable in posterior urethritis, but may be employed in anterior disease also. The bladder is filled with mild hot antiseptic through a soft-rubber catheter in the earlier period of the treatment, but later when sounds are in use through the author irrigating sound, which combines dilatation with retrojection at single passing of one instrument. When the bladder is copiously filled but not painfully distended the instrument is withdrawn and the viscous evacuated under Nature's own pressure and function, thus washing the urethra from end to end, cleansing, sterilizing, stimulating and healing it. The treatment is repeated once in three days. There should be no vesical disturbance or other disquieting reaction. For sterilizing the bladder itself the fluid should be retained by the patient for a short time before passing it.

The instillations are best of all, especially when used alternately with the irrigations. The methods are three: (1) Soft-catheter method, (2) Keyes-Ultzmann method, and (3) Bangs's method. All these methods agree as to the standard solutions of astringent and antiseptics, as already noted, localization according to subjective and objective symptoms, repetition every one, two or three days in quantities varying from a few drops to 1 or 2 drams.

The soft-catheter method consists of a short, velvet-eye, soft-rub-

theter, No. 10 or 12 French, attached to the author's modification of Hayden's instillation syringe, comprised in a hub flattened on two sides to prevent rolling and a larger hole to accommodate neck fluids. The fluid is drawn up into a catheter and syringe assembled and then instilled into the urethra by passing the catheter to the bulb, after lubrication. These instillations are given, as a rule, with the patient standing and holding a basin obliquely beneath his penis in order to catch any spurt along the catheter. It is not necessary to use the reclining position, which is reserved for patients who faint, with the Wolbarst basin between the thighs, a small piece of gauze over the penis to receive spatter, another under it to protect it from the basin and the forceps of the operator holding the catheter from slipping.

The sign of reaching the bulb of the urethra at the triangular ligament is important and should be learned early and well. The catheter slips easily along the urethra until the bulb is reached. Occasionally the bulbocavernosus muscle will grasp it, giving the sense of gentle, consistent resistance without jump or jerk. If this muscular action is absent, or when it is overcome, the catheter encounters a jump or jerk which marks its passage out of the bulb into the membranous urethra. It should then be withdrawn about a half-inch, which restores its tip to the bulb ready for the medication.

The Keyes-Ultzmann method may be applied to the anterior urethra as well as the posterior canal, for which it is primarily designed. The Ultzmann syringe modified by Keyes is shown in Fig. 72, and with the patient in the reclining position is passed to the bulb or suspected site of lesion and then the syringe is slowly emptied upon the mucosa as the instrument is withdrawn while the patient shuts the meatus to retain the fluid for fifteen to thirty seconds.

The Bangs method is much the same as that just described, with the great advantageous difference that the syringe sounds of Bangs are silver Béniqué instruments, with a very small tube passing through each, and made in sets, of which even sizes are usually sufficient from No. 14 to 32 French. The author has modified the instrument by putting finger supports on the sounds at their hub, which prevent them from slipping off the syringe. Advance in the size of sound used combines dilatation with the instillation. All other details are the same as the Keyes-Ultzmann method.

Applications rest on diagnosis with the bougie-à-boule of definite foci of disease, after the manner detailed under examination of stricture on pages 354 and 355. By choice the Bangs syringe sound is passed to such a point, carefully measured from the meatus, if instillations are chosen.

Surgical measures are nonoperative and operative, of which terms the latter is employed for such formal procedures as urethroscopy and cystoscopy, which may combine truly surgical details. Nonoperative measures comprise dressings which are rarely needed unless the discharge is copious and soils the underwear of the patient. The chief

are dilatation without or with irrigation, massage, irrigations, retrojections and ointment applications. Dilatation overcomes soft or dense infiltration and avoids organic stricture. A straight urethral sound may be passed in order to gain the patient's confidence. At first one number smaller than the bougie-à-boule is used to locate the lesions and then ascending one number at a time until the desired diameter is secured. There should never be any blood and never marked secondary irritation. Bangs's syringe sounds may be passed in ascending numbers in the same way through the infiltration until it is enlarged to the proper size. The nonirrigating straight Kollmann dilator, protected with a rubber cover against pinching the mucosa in the joints of its blades, may also be inserted if the lesion accepts No. 24 French at first and then dilatation not to exceed one number or even a fraction of one number at a time is performed. By the same steps the irrigating instrument may be used, and under slight pressure mild astringent and antiseptic solutions, as already enumerated, may be employed. Massage may be applied to the mucosa upon any of the solid instruments or the dilators before their expansion. Massage is fully discussed under its own head. It is secured by the act of dilating itself and by digital methods along the urethra held on the stretch upon a straight or other sound passed to the bulb of the urethra and finally by the reasonably rapid but always gentle passing of a flexible bougie-à-boule from meatus to bulb. Decongestion follows the cold or the heat of steel instruments as well as the massage, and benefit is seen in soft infiltrations, folliculitis and general catarrhal indolence. There should be no reaction in pain, increased discharge or blood.

Traumatism, physical, thermal or chemical, will convert a soft infiltration into a hard node or stricture, so that gentleness, moderate heat, weak solutions and weekly treatments by these methods alone are indicated, beginning about one month after the discharge and active treatment have ceased, as premature treatment is as irritating as over-energetic measures.

The irrigating sounds are a means of retrojection, dilatation and massage by the one passage of a single instrument. The author's models are preferred. These are described in Chapter VII on the Treatment of Stricture on page 368. They are passed cold, massage is performed upon their shafts if desired and then the retrojection is done by gently filling the bladder with a mild warm antiseptic to painless distention and then permitting the patient to evacuate it. The weak solutions of nitrate of silver are the best, alternating with argyrol 2 to 5 per cent., protargol 0.5 to 1 per cent. and potassium permanganate 1 in 10,000 to 1 in 2000 by gradual increase.

The ointment sounds are not very reliable or valuable because the mucosa of the urethra does not absorb the salves readily and because its musculature has a definite tendency to eject the salve as a foreign body. The author's model has advantages as follows: (1) The standard curve of the urethral sound with its tip shortened; (2) a blunt rounded tip which does not traumatize; (3) an inner tube to carry the

ointment to the base of the curve, which permits easy change of the ointment and sterilization of the sound itself; (4) a large reservoir of hard rubber for the ointment, of which there should be several for changing the treatment. The ointment sound is passed exactly like the standard instrument, and when its beak reaches the point to be treated a small quantity of the salve is squeezed out by screwing the handle of the reservoir down.

The cupped sound is like the standard sound, with numerous depressions cut into all faces of the shaft for a short distance proximal to the curve. They are likewise not reliable because the salve is apt to be wiped out of the cups during introduction. The ointment should be of weak chemical strength and may duplicate the preparations used in the irrigation and instillations, such as alum and zinc sulphate grains 0.5 to 1 to the ounce (1 in 1000 to 1 in 500) as astringents, argyrol 2 to 10 per cent. as an antiseptic and ichthyol 0.5 to 5 per cent. as a stimulant.

The operative measures are included under anterior urethroscopy, which from meatus to bulb will detect the individual lesions and verify the diagnoses of other measures. All details of equipment and technic are fully discussed in the Chapter on Urethroscopy, page 616. For our purposes here the following details suffice:

The urethroscope, either of the open-end Chetwood type or of the side fenestrum Buerger or McCarthy type, is the best instrument for verifying the data found with the bougie-à-boule and then of treating the lesions surgically by gentle curetting and incising diseased spots or chemically with graded caustics or thermally with the actual cautery or electrically with the galvanocautery, the high-frequency current of Oudin, the relaxing current of d'Arsonval or galvanization or faradization. In the last two the negative pole must always be within the urethra and a large positive pole carefully applied to the abdomen or back. In general the mild means which do not destroy the mucosa should always be preferred, because such destruction of the lining may be more extensive than apparent at the moment of treatment and prove to be the first step in traumatic stricture. Small syringes with very long silver tips have been devised for applying antiseptic and astringent medicines directly into diseased crypts and follicles and are of value if carefully used.

The urethroscope, when skilfully employed, will locate any lesion and submit it to treatment. As pointed out in the Chapter on Diagnosis it is necessary to be perfectly familiar with the healthy mucosa in its normal gloss and color, vascularity, edema, elasticity and crypts. These must be distinguished from the lesions found, such as excoriations, exfoliations, ulcers and infiltrations and diseased follicles and glands. Local applications of styptics, astringents, antiseptics and stimulants, of the high-frequency current of Oudin, of curettement and incision may readily be made through the urethroscope. These methods of treatment are more valuable in the complications than the simple chronic lesions.

General frequency of treatment, with all the foregoing localizing methods, should be without any irritation whatever and, as a rule, the number of applications begins with once a day for the mild irritations, with three times a week for the instillations, and with once in five to ten days for the instrumentation, massage and electrotherapy. The kinds of treatment alternate so that the same detail does not recur for longer periods, although the same type can do so within the prescribed limits. Distinctly stimulating applications are tempered finally to mild astringency and then cease to be followed by the gentle instrumentation after a period of rest and at the longer intervals.

*Aftertreatment.*—After the lesions are removed and when there remain only a few small light catarrhal shreds or a mucous discharge or a watery moisture, of which none attracts the patient's attention, it is best to leave him alone for from two to four weeks with only the persistence of good management and hygienic regulations. These should be procured by observing the patient each week and examining his urine and organs at each such visit. It is well to permit in this way Nature to exercise her full powers of resolution undisturbed before resuming active measures again. Of course, it is noted that no gonococci exist in any exudate before this rest from treatment is begun and the patient must be carefully instructed to return at once should any difference in his condition appear.

*Cure.*—Cure rests on the same principles laid down under this heading for acute anterior disease on page 73. The urine must be free of mucus, pus or shreds and remain so, without relapse, under irritation by instillations, diet and the beer test. A few mucous shreds, with little or no pus and absolutely without the gonococcus on smear or culture during a month or more of repeated examination, may be allowed. Examination of the semen in a condom worn at night to secure an emission is the last test and repeats the condition under which discharge during intercourse brings out hidden gonococci.

*Irrigation Method.*—Cautions and preliminaries all duplicate every way those of this method in acute urethritis, as do likewise associated methods of cure. In the same category are the internal measures graduated according to reaction and results.

Local measures comprise the same three methods of irrigation as the acute urethritis: Syringe-and-catheter technic, Valentine-James method and Chetwood double-current irrigation (which might be called irrigations without dilatation), and irrigation with dilatation. In all these steps without exception the patient always first urinates in the presence of the urologist and if insufficient urine is passed the anterior urethra should be flushed as a preliminary before passing the deep urethra into the bladder. This viscus is filled with any of the standard antiseptic and astringent solutions, given on page 73, and next the deep urethra and anterior urethra are irrigated as the instrument is withdrawn. Then evacuation of the bladder contents cleanses the canal as a retrojection.

In irrigation with dilatation, massage of the mucosa by the stret

ing is good additional treatment, secured by the Kollmann irrigating and nonirrigating dilators, by standard flexible or steel sounds with irrigation following, or by the author's irrigating sounds.

The soft, flexible instruments should precede any form of rigid instrument until the response to dilatation is known and all dilatation should be begun very late in the treatment, so as not to convert resorbing and soft infiltrations into dense and persistent lesions. If insufficient urine is passed the anterior urethra should be flushed with the syringe-and-catheter method as a preliminary. In all methods the duration of dilatation is five to ten minutes, its repetition every three, five or seven days, with preference for the long intervals, and no pain, blood or traumatism should accompany its increase of one number of the French scale and no more at each treatment. All mechanically expanding instruments are advanced a fraction of a number at a time if the slightest traumatism occurs. There should be no reaction to these dilatations.

The Kollmann irrigating dilators are passed exactly like a sound, with the blades closed and after thorough lubrication with boroglyceride or other soluble preparation. When in place in the midline of the body with the penis held stretched upon it the blades are slightly opened and the irrigating fluid, under gentle head, and mild concentration and easily tolerated heat are turned on. After about 1 or 2 quarts have flowed through the canal the reservoir is disconnected and the dilatation continued for the rest of the prescribed period. The blades are then nearly closed in order to avoid pinching the mucosa. Should this occur the blades are opened, the irrigation resumed and continued while they are again closed partly and the instrument is removed while the fluid keeps the mucosa back.

The Kollmann nonirritating dilators are protected with a rubber cover suggested by Valentine,<sup>1</sup> well smeared with a soluble lubricant, passed into the urethra like a sound and then expanded a part or whole number. It is closed fully on withdrawal because the rubber cover shields the mucosa. Irrigation is then performed by any method selected, preferably with the syringe-and-catheter technic in the author's opinion.

The standard flexible or steel sounds are gently passed into the bladder and when removed are followed by irrigation, as just stated. This technic is excellent, but has the disadvantage of two incursions either by the sound and catheter or the sound and a stream of fluid for the irrigation.

The author's irrigating sounds in slowly ascending sizes are far preferable to any of these other methods. All their details are described under treatment of Stricture on page 358. After passing one into the bladder the obturator is withdrawn, the viscus washed clean and then filled with any of the standard antiseptic and astringent solutions, which may also be instilled into the urethra as the sound is with-

<sup>1</sup> Loc. cit.



drawn. Then evacuation of the bladder flushes the urethra from behind forward. This sound requires one incursion for all four purposes—dilatation, washing of the bladder, instillation of the urethra and irrigation—or for any two or three of these aims.

*Aftertreatment.*—When the case seems to be at an end the after-treatment and observation are the same as those discussed under the conservative method on page 286.

*Cure.*—Cure in all its standards is the same as that outlined for the expectant treatment on page 286.

**Posterior Gonococcal Chronic Urethritis.**—The symptoms are subjective and objective with the general features noted in the opening paragraphs on symptoms in that the objective usually predominate over the subjective, which are divisible into three general classes—urinary, sexual and general. The subjective urinary symptoms are frequency, tenesmus and pain, which are usually more marked the nearer the lesions are to the sphincter of the bladder. The frequency may be very little or marked and rather urgency than true frequency. It is increased by congestion from intercourse, diet or drinking, which concentrates the urine, and decreased by diluents which render it bland. Tenesmus rests on the same factors and may be slight or severe. It rarely has the intensity of acute involvement but usually is a sense of uneasiness directly after urination. Pain may be due to acidity of the urine, ulcerations, or the obstruction of infiltrations and polypi. It is usually not important except in oversensitive individuals.

The subjective sexual symptoms are in great variety and among the most troublesome on account of nervous and psychic effects. They also vary with intensity and frequency and usually comprise deep-seated perineal pain on erection and ejaculation, loss of normal sexual enjoyment, premature ejaculation, nocturnal emissions, which may be normal, purulent or bloody, decreased desire and finally prostatitis, seminal vesiculitis and frequent attacks of epididymitis. The prostatitis shown under pathology may be of the exfoliating epithelial type or of the purulent type, both of which exudates may appear only during defecation to the alarm and discomfort of the patient. The epididymitis probably depends on prostatitis and seminal vesiculitis and appears usually without known exciting cause. Seminal vesiculitis is usually of the relapsing type with hardly any exudate for a short time and then copious amounts for a longer period. In the strict sense the symptoms due to prostatitis, seminal vesiculitis and epididymitis are the chronic complications of posterior chronic urethritis, and are fully discussed under this heading on page 313. The discharge may be free but scanty or only shreddy. Thus arise the frequent drops appearing during the day and relapsing from time to time or the drop shown only in the morning. In some cases there is no discharge which the patient sees except in the urine, as shreds otherwise complications in the prostate and vesicle are to be looked for.

The general or systemic subjective symptoms are absorptive, nervous

digestive. Many patients show certain absorption phenomena, especially in complicated cases leading to anemia, depreciation of general health, and the like, and arthritis, which have already been discussed under complications. The nervous symptoms are highly various and constitute usually worry, irritability and a great list of neuralgic pains and queer sensations, referable to various portions of the sexual organs, more commonly the glans penis, perineum, groins, testicles, thighs and loins. These may be constant but much more commonly come and go largely according to the patient's physical weariness and, therefore, most numerous toward the end of the day. The digestive elements depend largely on the mental worry and are loss of appetite and constipation. These general symptoms sometimes continue when there is no longer an objective basis and are, therefore, difficult of explanation. It is at least thinkable that those conditions in the blood which lead to the complement fixation observations may finally work out as the objective causes.

Objective symptoms are also urinary, sexual and general, but depend as to character on whether the case is one of the slow progressive type of gonococcal chronic urethritis or one of the quiescent recurrent type with acute and subacute exacerbations.

The urinary signs are that in the ordinary two-glass test both glasses show discharge, either in free pus or shreds, in accordance with the nature and activities of the process. The reason for this fact is that the first glass of urine does not wash away all the pus and clinging shreds from the posterior urethra although it does show the larger quantity. True prostatic elements and seminal vesicular contents may be in the second glass, either because these organs are complicated with the disease or because incidentally in the process of urination they have partially been evacuated. Careful microscopy alone proves the nature, state, source and infectiousness of such pus or shreds and the presence or absence of spermatozoa. The seven-glass test of the author shows pus in the Anterior Irrigation Glass evacuated into the anterior urethra from the posterior urethra, nothing in the Anterior Control Glass, abundance of detritus in the Posterior Urethral Glass which like Glass I will show various posterior urethral elements whose nature depends on the microscope. The Bladder Glass is negative, the Prostatic Glass by massage may be negative or show complicating lesions, while the same deductions are made from the findings in the Right and Left Seminal Vesicular Glasses. In other words, if only the posterior urethra is involved, and its annexa normal, the last three glasses will be practically or actually negative. The laboratory qualifies the source of the pus and desquamated detritus and the organisms as gonococci, and the complement fixation test as positive in cases of long standing or with complications.

The objective sexual symptoms are referred to the prostate, seminal vesicles and testes.

**Treatment.**—Description of management is completed in Chapter IX: General Principles of Treatment.

Of physical measures in the declining stage the stimulation of general massage is good locally and used systemically is equivalent to exercise in its hyperemic effects. Hydrotherapy in the acute and chronic periods will decongest and stimulate. Heat is better than cold because the latter so often induces catarrh. Electrotherapy must be used only in the declining period. Galvanism for cataphoresis is indicated locally in the anterior urethra. In the posterior urethra the direct d'Arsonval current may be used with the insulated metal electrode, measuring 100 to 400 milliampères intensity of current, for twenty minutes in duration and one to three times in frequency per week. The high-potential partially insulated vacuum electrode attached to the negative pole of the standard multiple-plate high-speed static machine with the positive pole grounded may be used. A spark gap of a  $\frac{1}{4}$  inch sets the intensity, ten minutes the duration and twice a week the frequency. No rectal treatment is necessary. The respective action of these currents is diathermic for the d'Arsonval and actinic and germicidal for the static machine. The results of each modality are, therefore, destruction of the infecting organisms by the local temperature produced in the diathermic current and by the actinic effect of the high-potential static current.

The d'Arsonval high-frequency current in the autocondensation method stimulates elimination and acts as a restorative. The static wave current with a long electrode placed over the spine attached to the positive pole of a high-speed static machine has also a very beneficent restorative effect.

The medicinal measures follow these leads by supporting the system, regulating the intestinal absorption, preventing toxemia and alleviating catarrhal tendencies through stimulating the mucosa to better action—all by systemic administration of tonics for the blood, nervous and digestive systems and mucous membranes. By local use in the declining stage mucous discharge is allayed by very mild band injections, irrigations and the physical measures already given. Later in the disease instillation and cautious instrumentation are begun. Details are described under anterior gonococcal acute and chronic disease. Applications through the urethroscope are rarely necessary. The prostate may be soft from sympathetic congestion or from early involvement or late lesions of follicular or parenchymatous prostatitis which makes the case pass over into one of chronic complications and is discussed in Chapter V. The seminal vesicles on one or both sides are, like the prostate, negative in the typical uncomplicated case and show even on a full bladder nothing or at most sympathetic congestion. In the complicated cases, however, they may show any degree of inflammation, infiltration and chronic abscess formation. The testes and vasa deferentia follow the rule of both the preceding organs, being negative in cases of true posterior disease but showing almost any stage of involvement of the epididymis and other portions of the vas in chronic persistent or chronic relapsing inflammation. The interval between the testis and its epididymis of the normal

organs should always be felt and when it is absent further investigation should be stimulated in the epididymis and along the vas up to the inguinal canal and through the rectum along the ampulla close to the seminal vesicle. There is frequently no objective basis for the uncertain and irregular neuralgic pains complained of by many patients, but, on the other hand, careful exploration often reveals an unsuspected focus.

Urethroscopy belongs distinctly to the objective analysis of gonococcal chronic urethritis but is deferred to Chapter XII of this work because it is so much a science itself. The objective general symptoms are usually absorptive, nervous and digestive and the more profound manifestations depend entirely on the severe examples of the disease, especially with complications, as stated in Chapter V on page 332. The absorptive signs are summed up in the general term toxemia and are manifested during the earlier and severe periods by fever, which disappears as the case settles into fixed chronicity; by anemia in the blood and sometimes by loss of weight. In this class would belong the positive complement fixation test. The nervous symptoms are general unrest, neurasthenia and excited reflexes really dependent on absorption and worry. Neuritis and neuralgia may be present and give their characteristic findings, the former tenderness over the nerve and irregular changes in its function and the latter often without objective data. The digestive elements are the coated tongue and the appearance of being out of health and constipated, which may proceed from either the absorption or the medication.

**Diagnosis.**—This depends on its usual four factors which should be carefully studied in Chapter VIII on General Principles of Diagnosis. The history of the acute attack shows obstinate and severe symptoms, sometimes improper and overactive management, followed by persistence of symptoms in a low and stationary degree or a slowly progressing and relapsing degree. The symptoms vary in their activity and as stated are urinary, sexual and systemic. The frequency, urgency and tenesmus of urination are the most important; associated with the chronic discharge or drop. The physical examination of the urine in test-glasses, especially by the seven-glass test of the author, shows characteristic and abundant exudate in the posterior urethral glass. The anterior urethral and control glasses may be negative and such elements as they contain will be from the posterior urethra. Urethroscopy is important and applied in the methods set down in Chapter XII on that subject. Cystoscopy should always be performed when the tenesmus is great in order to be sure that the bladder has not been invaded. The laboratory reveals the presence of the gonococcus and the complement fixation test is advisable in the more marked cases. The treatment step by step serves to corroborate all the other findings.

**Treatment.**—Posterior gonococcal chronic urethritis must be treated by all the methods usually employed for combating this disease, remembering that the annexa of this portion of the canal are very important structures.

Preventive and abortive treatments are literally nil, although good judgment in the diagnosis, due attention to the pathological lesions, full respect for the symptoms and precise selection of gentle means of treatment will do much to prevent posterior acute lesions from becoming chronic and especially from becoming complicated. It is, of course, not possible to abort the transition from acute to chronic lesions.

Reference to Chapter IX on General Principles of Treatment will supply all facts on management.

*Curative Treatment.*—Its procedures are two: the expectant method and the irrigation method, each having the same general essentials as have been noted under Anterior Gonococcal Chronic Urethritis on page 53.

The same accepted and established general principles of gentleness in dealing with the mucosa apply in this region as in the anterior urethra and of local and systemic stimulating, supporting and restoring measures.

Subjective local symptoms have been given as urinary in frequency, tenesmus, pain and discharge, as sexual in deep perineal chordé, disturbed ejaculation and coitus, nocturnal emissions and congested prostate, seminal vesicles and testicles without true complications. The systemic subjective signs are those of absorption and disordered digestion and nervous system. Corroboration of all these symptoms rests with objective examination and in particular with the author's seven-glass test and urethroscopy. Often the objective signs are the only definite symptoms.

Physical measures compromise the standard three—massage, hydrotherapy and electrotherapy, each requiring brief notice as extended discussion is elsewhere. Massage is efficient in controlling relaxed conditions by indirectly stimulating the mucosa and annexa of the deep urethra especially when the passive congestion extends to the prostate and seminal vesicles without true inflammation. Massage of the deep urethra may be done while an instrument is *in situ* exactly as in the anterior urethra with the ever-present caution against vigor sufficient to bruise the prostate. For this reason it should always be begun with soft, flexible instruments until tolerance is known. If well borne, metal instruments may later be used but in the average case had best be omitted altogether. Hydrotherapy is local, applied to the urethra or the rectum or general to the body at large. Its local urethral measures are largely covered by the irrigation treatment in any of the three technics discussed on page 71, and its rectal development requires hot sometimes cold, normal salt solution for those forms of passive relaxation also benefited by massage of the prostate, seminal vesicles and urethra. Its details are reviewed under posterior acute urethritis a irrigation with double-current tubes or repeated enemata or the psychrophore or thermophore. General body baths are not of much value except for increasing elimination when there is a tendency to absorption and in controlling urethral chill and other occasional ill effects instrumentation, but hot sitting baths are called for by indolent mucos

old may be applied to the deep urethra with sounds of medium sizes, 1-22-24 F., dipped in iced water, passed every three or four days and retained for ten minutes, if benefit ensues. Sharp or dull neuralgic inter pains indicate cessation.

The electrotherapy is also local or general and has been fully discussed under Anterior Chronic Urethritis, on page 279, as to equipment and machines and electrodes for developing and applying the various modalities, as to medicinal supplies and as to selection of case and duration and frequency of treatments. The electrodes for the posterior urethra must have the form of sounds for suitable penetration and apposition. Like hydrotherapy, electrotherapy through the rectum is of benefit and requires special electrodes.

Its local methods are either posterior urethral or rectal or both in correlation or sequence. In the posterior urethra if the purpose is to stimulate relaxed muscularis, a faradic current is employed through the curved electrodes with 30 interruptions to the second corresponding with the normal fibrillary contractions of muscle tissue and so feeble in intensity as not to be measurable but so strong as to cause painless physiological thrill. Either pole may be put into the urethra, but a large indifferent electrode is applied to the abdomen. Treatments persist five or ten minutes unless discomfort or pain arises and visits like those for instillations are every other day dependent on results which are always free of secondary irritation. There is no after-treatment—the less meddling the better. As in the anterior urethra the glass electrodes may be employed for local effect in two ways. If attached to the negative pole of the high-speed static machine the effect is sedative, which is advisable in irritable conditions; but if connected with the positive pole of the machine the action is hyperemic, stimulating, germicidal and actinic.

In rectal application a static machine of standard type is used with metal electrodes and the static wave current for relaxation without infection. The connection is to the positive pole while the negative pole is grounded. The tension of current is that of a spark gap of  $\frac{1}{2}$  to 2", according to effects, with a frequency of interruption of 150 to 200 per minute and a duration of treatment of twenty minutes and a frequency of visits of every other day and then twice a week. Intensity and frequency of treatment decrease with the improvement and there is no after-treatment. The results are a painless, profound, alternating, physiological tissue contraction and relaxation—a massage more localized and energetic but less traumatic than digital massage. In infiltration with infection a vacuum tube in the rectum is applied over the urethra and the current is produced by a static machine with the negative pole connected to the electrode and the positive pole grounded. Intensity is determined by a spark gap of  $\frac{1}{2}$  to 1" and  $\frac{1}{2}$  to 1 milliamperè of current on a reliable meter in series with the negative side of the machine. The duration is ten minutes and the frequency of visits two to three times per week with longer intervals as the improvement occurs, but the intensity of the current and the duration of treatments are not

changed. The results are due to actinic discharge from the vacuum electrode which penetrates the tissue from two to six millimeters and gross tissue contraction produced by the high-potential static current. There is no aftertreatment.

Systemic application is discussed under this topic in Anterior Chronic Urethritis on page 281; but it must be remembered that the continuation of the symptoms causing worry and the persistence of the lesions inducing absorption are in posterior chronic urethritis fertile causes of disturbances in digestion, elimination, circulation and nervous efficiency requiring restoration. Electricity is of value in many cases.

Medicinal measures are systemic and local and serotherapeutic. The systemic medication of influence on the urine or mucosa comprise the drinking of mineral or plain water, the various urinary diluents and antiseptics, blennorrhagics, and sexual sedatives. A bland urine prevents irritation and aids in controlling the inflammation. Antiseptics and blennorrhagics avoid possible transfer of infection with instruments while the sexual sedatives allay the excitement due to irritating lesions or the passive congestion of the prostate and vesicles. Urethral chill after instrumentation is corrected in sthenic patients by one pill containing:

R—Morphin sulphate . . . . .	0.0078 to 0.0156 grammes (grains $\frac{1}{4}$ to $\frac{1}{2}$ )
Tincture of aconite . . . . .	0.0625 to 0.1875 grammes (minims 1 to 3)
Quinine sulphate . . . . .	0.1875 to 0.3125 grammes (grains 3 to 5)

Asthenic subjects require the substitution of nitroglycerine, grains  $\frac{1}{16}$  to  $\frac{1}{8}$  for the aconite.

In serumtherapy, as outlined in Chapter IX, lies a measure of value in building up bodily resistance against infection and absorption. The more efficient form seems to be active immunity produced by the injection of gonococcal or mixed bacterins; but passive immunity from injection of serums may also be tried. Autogenous bacterin or serum should receive first attention and stock products second choice only after unsatisfactory results with the former.

The local medications comprise hand injections, instillations, retrojections, dilatations and irrigations and the methods are again two, conservative and irrigation. Patients cannot safely use hand injections in the deep urethra which are therefore abandoned in favor of retrojections performed with the soft catheter or the reflux catheter or as detailed under sounds and dilators in later paragraphs with the author's irrigating sounds or the Kollmann irrigating dilator. A soft, velvet-eye, rubber catheter No. 16, 18 or 20 Fr. is slowly passed into the bladder, which after evacuation is filled with one of the standard astringents or antiseptics, listed on page 73, several times until clean and then left full while the catheter is withdrawn and the same or slightly stronger solution is instilled in very small quantity and with greatest gentleness along the posterior urethra. The patient then voids his medicated bladder-contents, completing the treatment, which is repeated every one,



two or three days according to reaction. Improvement requires longer interval and greater strength of medication but never up to irritation. One in 15,000 to 1 in 10,000 or 1 in 5000 of the zinc and alum astringent followed by 1 in 10,000 to 1 in 5000 potassium permanganate and next by nitrate of silver solution of the same strength is the best sequence. Of less value is the reflux catheter because in the posterior urethra it is difficult to prevent slight spasm of the compressor urethræ muscle which confines the fluid unduly and sometimes leads to chemical irritation and then infection of the prostate and seminal vesicles. Its size should always be small and the fluids begun at lower strengths than those specified.

**Ointment Sounds.**—The best are Young's<sup>1</sup> and the author's.<sup>2</sup> Their features are shown in Fig. 71, which gives from left to right the plunger and shaft of the Young instrument, without detailing the lateral outlet. The curved sound, inner sheath and hard rubber container and expression screw of the Pedersen apparatus are clear. The sheath within the sound delivers ointment near the outlet and permits boiling

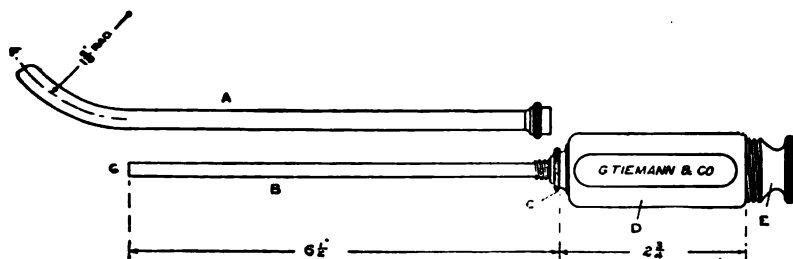


FIG. 71.—The ointment-applying sound.

the sound with little grease in the water to coat other instruments. Disadvantages of ointments are that the urethra is not strictly absorbent as the skin is, and that moisture and mucus further prevent action of salves safe on mucous membranes.

For instillations the soft or hard instrument may be used, with preference for the former in the early periods, when the mucosa is apt to be irritable, and for the latter in the later stages, when the lining is indolent and relaxed or infiltrated. The instruments are, therefore, a syringe and soft catheter, the Keyes-Ultzmann syringe or the Bangs syringe sound and treatments are repeated every one, two or three days of ascending strengths of silver nitrate solution 1 in 1000 to 1 in 100, with only a few drops at a time especially of the higher percentages. The syringe-and-catheter method requires the Hayden or other syringe and a soft-rubber velvet-eye catheter No. 16 to 20 French passed into the deep urethra, where it leaves its deposit of medicine. The Keyes-Ultzmann syringe (Fig. 72, 1) is passed like a sound until it reaches

<sup>1</sup> Tr. Am. Urol. Assn., 1908, ii, 73.

<sup>2</sup> Pedersen, V. C.: Med. Rec., May 30, 1908.

the vertical position with the patient recumbent when it discharges the drug into the prostatic urethra. The Bangs syringe sound (Fig. 72, 3) is also used like a sound in the reclining position of the patient. Its tip is in the posterior urethra when its shaft is vertical to the table. The medicine is then delivered upon the mucosa. This instrument has the advantage of a full assortment of tips in the French urethral scale so that a selection for beginning the instillation and for continuing it in combination with dilatation may readily be made. In the author's



FIG. 72.—Posterior urethral syringes. 1, Ultzmann syringe (Keyes pattern), modern metal form, with removable screw-joint tip, in contrast with the original hard-rubber form with fixed tip; 2, glass barrel and plunger, slip-joint modification of the Ultzmann syringe; 3, Bangs's syringe sound, with assorted sizes of slip-joint tips; size 13 Fr. assembled with the syringe is shown; 4, Bangs's syringe sound, 24 Fr. tip separated from the syringe and showing the long, ground hub; 5, author's hub for employing any syringe for the Bangs sounds, with standard screw for the syringes and standard hub for the tips.

opinion it is the best of the three methods in skilled hands. Instillations in ordinary cases begin with silver nitrate solution 1 in 5000 and ascend to 1 in 1000 or 1 in 500, but where the mucosa is more damaged and tendency or actuality of prostatitis and seminal vesiculitis is present smaller quantities of greater concentrations are allowable, 1 in 500 to 1 in 125 preferably with the soft catheter especially at first.

Dilatation is gentle increase in the size of instruments used, never with unfavorable reaction, such as bleeding, pain, fever or prostration,

after other symptoms except chronic drop and shreds and response to treatment have ceased. It requires the pre-passing of urine or washing of the anterior canal, then flexible



-Instillation of the prostatic urethra. The Bangs syringe sound has been a step of elevation (as in the steps of passing a sound, see Fig. 64). The left hand holds the penis, urethra and sound, while the right hand evacuates the syringe.



-Retained instillation of the prostatic and bulbous urethra. The largest size of Bangs's syringe sound has been passed, the deep urethra has been instilling slow withdrawal of the sound, the bulbous urethra has been treated. It is retained a few moments by leaving the instrument at rest on the abdomen.

or metal instruments in the form of standard sounds, Béniqué's sound the author's irrigating or ointment sounds and Kollmann dilators.

In the earlier periods the flexible instruments are preferred until about 24 French is reached, when steel instruments are better. If irrigation is desired with the flexible lisle-thread instruments a catheter may be mounted on a woven sound as its obturator, passed into the bladder and then freed of the sound, thus permitting treatment of the bladder and filling it for the retrojection as discussed elsewhere.<sup>1</sup> After cleansing the meatus and lubricating the sound it is engaged in the meatus and anterior urethra, where supported by the hand it is slightly bent in order to facilitate passing the membranous urethra. After this step it is passed directly into the bladder with the penis held horizontally, as its flexibility permits it to follow the curves of the urethra without other manipulation.

The method of passing metal sounds, illustrated in Figs. 98-102, consists of five steps: gravitation, elongation, elevation, depression and penetration. In *gravitation* the sound by its own weight enters the meatus and anterior urethra while both are held in the middle line of the body. Still in this general position, *elongation* of the penis over the sound as far as possible is performed, which usually carries the tip of the instrument almost to the bulb, also of its own weight. *Elevation* of the handle to the vertical position now carries the tip of the instrument through the bulb and into the membranous urethra, especially if the instrument is made to hug the roof of the canal by support upon the perineal body with the other hand or by slightly pulling the instrument upward or, in difficult cases, with the finger in the rectum as a guide. *Depression* of the handle in the middle line of the body now carries the tip of the instrument up to and through the sphincter at about the time when the shaft of the sound is parallel with the table. *Penetration* is now performed by pushing the sound directly into the bladder as far as possible without pain and rotating it gently there to prove its proper position of the curve within the bladder and the shaft within the urethra. In none of these steps does the sound leave the middle line of the body and all the indirect and twisting movements of reaching the bulb often described are so useless as to be foolish. Exactly the same steps are followed in passing cystoscopes, the cystourethroscope, straight sounds, the Kollmann dilators, metal catheters, stone searchers, stone crushers, or any other urethral or bladder instruments.

For urethral retrojection the author's irrigating sounds are described on page 370. As shown, one penetration with these instruments permits washing the bladder and filling it with fluid for evacuation and retrojection. If, on the other hand, irrigation is desired, then the Kollmann irrigating dilator is called for, as described under Anterior Chronic Urethritis on page 287, and the current maintained into the bladder and back through the urethra. The instillating sounds are described

<sup>1</sup> Pedersen, V. C.: Loc. cit.

der instillations in the previous paragraphs and the Bangs form of instrument is best.

The cupped sounds have cups in their shafts for applying ointments to the urethra, such as 5 per cent. nitrate of silver or argyrol in lanolin. The cups should be small, with smooth margins to avoid irritation and deep to hold sufficient ointment, whose melting point must be low so that during retention it will reach the mucosa.

The author's<sup>1</sup> ointment sound depicted in Fig. 71 is a more reliable method of applying this treatment. It consists of a silver outside tube shaped like a sound with an end opening, into which slips the inner sheath carrying the ointment to the base of the short curve. By screwing the handle together the salve is forced into the urethra. Removal of the handle and sheath permits boiling the tip with loss of little salve. Several handles and sheaths each containing a different ointment are necessary. The watery element of the mucus and of the mucosa itself largely prevents the absorption of ointments and the action of the plug of salve as a foreign body causes not only an outpouring of mucoserum but also muscular action for its expulsion. Greasy fluids in the urethra are therefore a failure.

Straight sounds in the anterior urethra are usually employed, because their length just reaches the bulb of the urethra and does not invade the posterior urethra. The curved sound may be used if the urologist stops with the second step of elongation described by the author in the technic of passing these instruments in Fig. 97. The tip of the curve is then in the bulb ready for the massage if desired or for withdrawal after the dilatation.

The Kollmann dilators of the nonirritating and irrigating type are valuable instruments and discussed under Anterior Chronic Urethritis. The irrigating form is the most serviceable because one may use it without or with fluid, the straight instrument for the anterior and the curved form for the posterior urethra. Their insertion is spoken of on page 376. The irrigation may involve the bladder alone or include the urethra.

Surgical methods are nonoperative or operative, of which the former are chiefly comprised in the technics already covered, leaving the operative means which include urethroscopy and cystourethroscopy. Cystoscopy is performed as a routine diagnosis of the bladder in posterior chronic urethritis.

Urethroscopy is fully discussed in Chapter XII on page 616, but finds an important activity in chronic posterior urethritis whose lesions involve the mucosa as a whole from the membranous urethra up to and even into the bladder, including the mucous crypts and follicles of the membrane and in complicated cases, to be described later, the ducts of the prostate and testicles emerging in this portion. Every possible change in the mucosa due to penetrating inflammation is found and may be advisedly treated through the urethroscope with

<sup>1</sup> Pedersen, V. C.: *Loc. cit.*





becomes, as already shown, an adaptation of the conservative method which may therefore be regarded as including the irrigation technic, as far as the posterior urethra is concerned.

*Cure.*—Cure in the posterior urethra involves all the cautions of those laid down for the anterior urethra with greater emphasis because the primary sexual glands or testes with their ducts and the secondary sexual gland or prostate with its ducts all deliver their secretions into this part of the canal. The tendency of the gonococcus to affect these outlets along with the mucosa as a whole, although there may be no complications resulting in the strict sense, requires the most careful analysis on repeated occasions before a final certificate of health is possible. Therefore the secretions of these glands must be obtained by careful massage and stripping of the seminal vesicles and ampullæ of the vasa deferentia and of the lateral and middle lobes of the prostate. This will often suffice to furnish specimens in proof of present or absent infection. A better test in the author's opinion is to have the patient wear a condom at night until after a few times a seminal emission occurs which procures a specimen under sexual excitement, which is exactly the circumstance in which hidden gonococci show themselves. Such organisms are the most treacherous in diagnosis and treatment. Smear and culture bacteriology must be carried out and the gonococcal complement fixation test must never be omitted, because the chronicity and absorptive tendencies in the deep urethra increase its frequency and reliability.

## 2. NONGONOCOCCAL CHRONIC URETHRITIS.

*Varieties.*—Exactly as in gonococcal lesions, the nongonococcal infections vary as to location. Anterior, posterior and anteroposterior are recognized. Those as to source, as given in the clinical portion of this work, are: catarrhal, diathetic, suppurative, syphilitic, chancroidal, herpetic and traumatic.

*Clinical Features.*—The etiology, pathology, symptoms and diagnosis are included in the Chapters on Acute Urethritis and that on the Complications of Acute Urethritis for more definite contrast with the clinical facts of gonococcal urethritis. Similarly, here in this chapter the treatment of these two general forms of urethritis are considered side by side for emphasis.

General principles are the same as those laid down for the treatment of gonococcal urethritis with regard for the periods of the disease, for gentleness and caution rather than energy and abandon.

### **Anterior and Posterior Catarrhal Acute and Chronic Urethritis.**

*Varieties.*—These are concerned with primary and secondary cases. Primary infections concern us here because the other form, secondary, is seen during the invasion and during the termination of other types.

*Treatment.*—Preventive and abortive treatments in catarrhal subjects require good health, elimination, exercise, suitable diet and avoid-



direct applications of antiseptic, astringent, styptic and even caustic solutions, and of stimulating and cauterizing strengths of the high-frequency current of Oudin and of directly surgical procedures in sharp and blunt curetting and incision. The lesions thus treated are (1) exfoliation shown by loss of normal gloss of the mucosa requiring mild astringent and possibly antiseptic medication; (2) erosions reaching the deeper layer of epithelia and indicating mild caustic stimulation and at times blunt or sharp curettement; (3) ulcerations which are the next destructive process and relieved by slightly more energetic treatment of the same kind with light fulguration added; (4) exuberant granulations are the first productive lesions and need reduction with the caustics, curette and stronger high-frequency current; (5) *granulomatosa* as the further development of exuberance and (6) *papillomata* as true new growths both require removal with the Oudin current at one or more sittings. Invasion of the mucous crypts and follicles is a complication whose treatment is discussed under that heading. The individual technic of all these treatments is shown in the Chapter XII on Urethroscopy.

Cystourethroscopy permits treatment of the neck of the bladder over the surface covered by the folds of the mucosa over the muscle and of the cervical portion of the viscus in the author's<sup>1</sup> subdivision of the cavity. With the instrument in place the ureterotrigonal and subperitoneal quadrants may be satisfactorily examined with the ureters in verification of absence of infection. Lesions of any of the foregoing types are treated on the principles stated.

Cystoscopy should be done if there is any suggestion that the bladder as a whole has been invaded, as the earlier the treatment the surer the result in bladder work. The cystourethroscope will reach only the flow and not the urachal and retropubic quadrants.

*Irrigation Method; General Principles.*—As in anterior and posterior acute and chronic urethritis, the irrigation treatment has its application and advocates, but in the last analysis it really is retrojection because in both the Valentine-Janet and the Chetwood double-current method the sphincter is overcome by pressure of the stream of irrigating fluid until the bladder is washed and distended, after, of course, preliminary cleansing of the anterior urethra and urination by the patient. In the syringe and catheter method following the same introductory steps the catheter enters the bladder, which is again washed and filled ready for the patient to retroject his own canal under Nature's pressure during urination. With the Kollmann irrigating dilator perhaps the truest irrigation is reached, because with the curved instrument in the posterior urethra and bladder, gently dilated and holding the two organs open, the irrigating fluid flows into the bladder and out again. In this method, however, retrojection may also be the last step by filling the bladder before the instrument is withdrawn. In review, therefore, this part of the irrigation treatment

<sup>1</sup> Pedersen, V. C.: *Loc. cit.*

**Anterior and Posterior Pyogenic Acute and Chronic Urethritis.—**

**Treatment.**—Preventive treatment is the analogue of that in gonococcal urethritis, and only tentative measures in refined treatment, careful diagnosis and faithful obedience to orders by the patient may avail. Asepsis in the passing of instruments with irrigation of the urethra previously and subsequently is important when pyogenic organisms are known to be in the canal. The author's irrigating sounds are most important in this relation. There are no means of abortion in the true sense, except continuation of the irrigations during the presence of any signs of incubation or invasion.

Management is completely described in its requisites in Chapter IX on General Principles of Treatment.

**Curative Treatment.**—The cure depends on the same principles as gonococcal urethritis. The local and systemic symptoms are the same in nature, and often in degree as those of gonococcal urethritis with no means of distinction except the microscope. Quite frequently the pyogenic organisms are associated with the gonococcus and their growths is so exuberant as to hide the latter in the florid period. The varieties of organism are fully explained in the paragraphs on etiology on page 21. The pathologic and symptomatic indications virtually duplicate those of gonococcal manifestations.

The physical measures are exactly the same as those described for the parallel gonococcal infections as to massage, hydrotherapy, and electrotherapy, both local and general, in both anterior and posterior acute and chronic manifestations. The reader is referred to the paragraphs on these subjects, in previous chapters.

The medicinal measures both by systemic and local exhibition are the same as in gonococcal inflammation but the serumtherapy varies slightly in that autogenous or stock bacterins of the predominating organism, such as the bacillus coli, for example, or autogenous mixed bacterins containing all the flora of the case or the stock mixed bacterine of Van Cott may be tried often with greater advantage because the latter contains the gonococcus which is occasionally present but overgrown by its associates. Similarly the gonococcal complement fixation test in severe and prolonged cases will, if positive, give proof. Local administration is—by the expectant and irrigating methods—irrigations, injections, retrojections and instillations preferably during the period of decline and thereafter, and followed by applications with the urethroscope in the period of termination. All the methods and medications are the same as in gonococcal invasion, likewise surgical details, such as mild dilatation with soft, flexible or metal sounds, the author's irrigating sounds, the Bangs instillation sounds and the Kollmann irrigating dilators. Instrumentation is postponed until the infiltration stage, if present. In this disease, therefore, the stages, means and drugs of treatment and the frequency of visits are all correlative.

**Cure.**—Cure is the relief of infection shown by smear and culture and the blood test to eliminate the gonococcus as a cause.

**Syphilitic or Chancrous Urethritis.—Treatment.**—Preventive treatment involves measures against the inoculation of syphilis not in the province of this work but consisting generally of careful cleansing after intercourse, followed by wet dressing and ointment during the first twelve or twenty-four hours. Thorough sterilization of all instruments used in connection with syphilitics is an essential.

Abortive treatment is not possible, as proved by the long and bitter controversy among syphilologists of the passing generation.

Management is completely described in its requisites in Chapter IX on General Principles of Treatment.

**Curative Treatment.**—The principles involve surgical dryness and cleanliness, healing applications and systemic treatment.

The electrotherapy consists in fulgurating the lesion to desiccation only and not to cauterization. The spark gap is  $\frac{1}{2}$  of an inch and the application must dry or blanch and not burn the lesion. One application is sufficient unless the chancre is a large one. The static machine of the multiple plate high-speed type is best for producing this current.

The medicinal measures are the intramuscular injection of the soluble or insoluble mercurial salts, the intravenous injection of salvarsan, neosalvarsan or cacodylate of soda and the ingestion of mercury, or arsenic both without or with iodid of potash or iodid of soda to tolerance. Alkaline mineral waters appear to aid metabolism and assimilation of the medicine. The urine should be bland to stop irritating the urethritis and chancre. Local means are wet dressing or salve containing mercury applied on gauze or cotton to the lesion, which is usually at the meatus, and frequently changed for cleanliness. If the chancre is intraurethral, from 0.5 to 1.0 cm. up the canal, ointment may be squeezed upon it through the meatus and held in place by a cotton plug. After healing, the infiltration is resolved by the continuous application of ointment and later by gentle dilatation with soft sounds.

**Cure.**—Cure of the chancre and the urethritis is not a cure of the syphilis, which must be prosecuted along accepted lines with untiring watchfulness and judicious zeal by both physician and patient, but never to the limit of undoing the patient's well-being or health with mere medication.

**Chancroidal Urethritis.—Treatment.**—Preventive treatment offers nothing new over those presented for both gonococcal and syphilitic urethritis, as examples, and is equally successful when promptly and properly carried out. Abortive applications are unreliable except perhaps careful cauterization at the earliest possible sign of any abrasion and its infection.

**Curative Treatment.**—The symptoms and indications are the factors. The symptoms are those of ardor urinæ from a painful irritating and extending sore at the meatus or just within it with subsequent purulent exudate and even urethral discharge making the indications those of immediate destruction of the virus, healing of the sore and correction of the urethritis.



The general methods are identical with those for chancrous inflammation except that the exciting organism is the bacillus of Ducrey and requires slightly different application. There are no differences in either management or physical means between the two diseases. Electrotherapy is fulguration to the coagulation or incineration strength with a spark gap of a  $\frac{1}{12}$  of an inch applied to the sore or sores until the coagulation is apparent. The number of treatments is one for small lesions and several for larger lesions. The multiple-plate high-speed standard static electrical machine produces the best current for this purpose.

The medicinal measures, as the disease is local only, offer no internal measures such as the blood test and no administration of salvarsan, mercury or any other drug unless required by the rare cases of great absorption. The local treatment of the chancroid at the meatus means penile baths in hot antiseptics, of which potassium permanganate 1 in 2000 to 1 in 1000 is best in the author's opinion, associated with wet dressings of it on gauze or cotton or with a paste of crystals or argyrol held in and upon the lesion with a dressing. Black wash (U. S. P.) is also a valued wet dressing in full strength. Mild caustics may be cautiously applied protecting the canal with a plug of cotton from leakage into it. The slough is curetted off and the same caustic in astringent strength immediately reapplied to sterilize the new surface. This method requires local anesthesia with a few crystals of cocain or its derivatives dissolved in the exudate for five or ten minutes. The use of caustic and curette is frequently amazingly successful but requires skill and judgment. Stenosis after healing requires dilatation with soft sounds or a meatotomy or an internal urethrotomy according to the situation and the density of the scar.

*Cure.*—Cure closes with healing without complications and with correction of the urethritis. The bacillus of Ducrey may bury itself in the lymphatics and cause late adenitis in the groins, which in turn indicates evacuation and drainage along surgical principles.

**Traumatic Urethritis.**—**Treatment.**—Preventive treatment sums up in good judgment in the application of dilute solutions, in temperate heat or cold, in deliberate and gentle passage of all instruments, which must be neither too large, too hot, too cold, unclean nor rough, in weak currents and proper polarity of electricity and finally in nothing to inflame, irritate or destroy the mucosa even superficially. The abortion involves in the presence of blood, pain or irritation in mild cases, simple diet, rest in bed, cold applications, mucous membrane sedatives and mild astringent irrigations or retrojections of tolerably hot nitrate of silver solution under gentle pressure and copious quantity.

The particulars of management are described in Chapter IX on General Principles of Treatment.

*Curative Treatment.*—The usual elements of indications and symptoms are present.

The medicinal measures are sedatives to quiet the hemorrhage and pain by systemic administration in severe cases and none is better than

a small dose of morphin hypodermatically. Locally hot irrigations and retrojections, at first very dilute and of tolerable temperature, are more important than merely chemical action. There should be no application through the urethroscope and no other instrumentation for several days after the traumatism is relieved, in cases where it arose during these forms of treatment.

*Cure.*—Cure is usually absolute, leaving the canal intact except for the gonococcal sequel, which usually leads to such incidental disturbances.

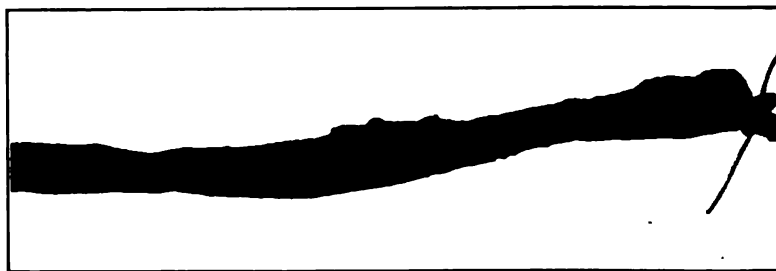


FIG. 75.—Author's case of lunar caustic traumatic urethritis. Slough of the anterior urethra of nearly natural size, caused by lunar caustic burn. The meatus is at the right and the deeper portion at the left of the photograph.

The author<sup>1</sup> has reported a remarkable example of chemical traumatic urethritis from a burn with lunar caustic put into the urethra to abort a gonococcal infection. This it failed to do but the slough shown in Fig. 75 was cast at the end of a few days and perineal drainage of the bladder was necessary to avoid infection of it. Dense stricture of about 22° F. was the end-result.

<sup>1</sup> Pedersen, V. C.: Tr. Am. Urol. Assn., 1912, vi, 104 to 106.

## CHAPTER V.

### COMPLICATIONS AND SEQUELS OF CHRONIC URETHRITIS.

**General Considerations.**—As stated in the Chapter on Complications of Acute Urethritis, the gonococcal and other pyogenic infections are the most severe, prone to have acute complications, to become themselves chronic and to be followed by the same complications in chronic type. This law is essential to the nature of the disease and the delicacy of the tissues attacked and to their relatively slight recuperative powers, as a mucosa once deeply damaged never fully restores itself.

One fact concerning chronic complications is that they in themselves are often the sole cause of the persisting symptoms. Thus in a certain sense a diagnosis of chronic urethritis is often given, whereas in reality the urethra has recovered but one of its annexa is still in a state of chronic lesions. It was not until the urethroscope was thoroughly developed that these details were appreciated, and, on the other hand, a chronic complication may keep the urethritis frequent in its relapses, exacerbations and extensions. For this reason also, the importance of full exploration for such complicating foci is obvious.

For the purposes of this work a complication may be regarded as a condition arising during the course, more or less in virtue and with the essential cause of the primary process. A sequel, on the other hand, is the result of the primary process after the latter has clinically ceased as a disease condition. In urology no example of a sequel is better than stricture.

**Definitions.**—Unless otherwise stated, the definition of individual chronic lesions is the same as that given under the acute forms with the sole element of chronicity added.

Similarly, the clinical description of the chronic complications is based on and abbreviated from that of the acute varieties, for the sake of space. Thus full comprehension involves knowledge of both acute and chronic manifestations.

**General Clinical Features.**—Chronic complications may occur during chronic urethritis of any form, catarrhal, diathetic, nongonococcal, pyogenic and gonococcal, and all resemble each other closely, but the last is by far the most common and typical, and the others are found usually in nonresistant soil and subjects. As previously in this work, therefore, the gonococcal will be taken as the type, with the natural subdivisions into complications of anterior and posterior chronic urethritis.

**Varieties.**—As just stated, the anatomical forms as to location are anterior and posterior, and as to distribution systemic, of the bodily economy at large, and local, or urogenital, of the sexual and urinary types. Chronic complications of the anterior urethra, like the acute, rarely have true systemic manifestations but the reverse obtains in the posterior portion of the canal, under which heading they will be discussed. The local complications are essentially sexual and include the same list as stated under Acute Complications: that is, *phimosis*, *paraphimosis*, *lymphangitis*, *lymphadenitis*, *littritis*, *folliculitis*, *cowperitis* with retention and *cowperitis* without retention.

### COMPLICATIONS OF ANTERIOR GONOCOCCAL CHRONIC URETHRITIS.

#### A. UROGENITAL GROUP.

##### 1. *Sexual Forms.*

There is strictly no urinary group of complications in anterior chronic urethritis.

### CHRONIC PHIMOSIS AND PARAPHIMOSIS.

**Significance, Occurrence and Etiology** are much the same as given on pages 83 and 84. The condition is due to balanoposthitis from mixed infection and the relapses of the urethritis. The irritation of chronic discharge, excoriation of dressings and the overstimulation of applications are factors.

**Pathology.**—Pathology is definitely included under this heading in Chapter II on Complications of Acute Urethritis on page 83.

**Symptoms.**—Subjective and objective symptoms are as already described with the change that the patient is rarely free of trouble with his glans and foreskin. There is almost always excess of moisture and smegma with relapses of the acute symptoms with or without parallel relapses of the urethritis.

**Diagnosis and Treatment.**—For the sake of brevity and correlation both these topics are discussed under Acute Phimosis in Chapter II, on Complications and Sequels of Acute Urethritis on pages 84-6.

### CHRONIC OR RELAPSING BALANITIS, POSTHITIS AND BALANOPOSTHITIS.

**Definition.**—The modified skin over the glans and within the foreskin is susceptible to the same sites of chronic inflammation as in acute disease and receives the same terminology.

**Varieties.**—Varieties duplicate those seen in acute involvement to which the reader is referred. The important forms are as to foreskin, retractile and irretractile and as to course slowly progressing with



little change and relapsing with periods of intermission and finally as to infection, suppurative and gonococcal and allied germs. Cases curable by circumcision and those not modified by this procedure are also recognized.

**Etiology.**—Etiology is the same as in acute balanitis and comprises malformations of the foreskin, low resistance especially to mucosal disease and the presence of infection from chronic urethritis and of depression from constitutional disease like diabetes. Upon the favorable soil thus prepared a low grade of infection persists and progresses in the persistent type or a more active form of involvement appears and reappears as relapses and remissions in the relapsing type.

**Pathology.**—Such persistent or relapsing chronic inflammation is in the essence of the process the same as similar lesions anywhere else and involves in whole or in part the modified skin covering the glans and lining the foreskin, either superficially or deeply, according to age or activity of process. The tendency is toward thickening, loss of elasticity and recurrence of discharge. The temporary lesions are only those of the subacute process during the exacerbations while the permanent lesions are the chronic inflammation, infiltration, desquamation, retraction and at times deformation and compression of the glans and foreskin through the dense inelastic skin. The associated lesions are the natural abnormality of the foreskin which preceded the lesion and may in turn be augmented by the chronic disease and thus be both cause and complication. The chronic urethral discharge is another allied condition leading to fresh outbreaks and sometimes itself likewise involved.

**Symptoms.**—There is no separation of the disease into invasion, establishment and termination because invasion does not occur unless as part of each relapse and the disease is ordinarily without ending. As in the acute balanitis there is no systemic syndrome. Patients complain of local subjective symptoms, such as intense itching, discomfort, return of the discharge in a relapsing case or continuance of discharge in persistent cases with the usual soreness and odor. They find the foreskin once retractible now irretractible or at best with great difficulty, pain and fissuring and rarely absence of complete erection within the glans proper. The objective symptoms are those of chronic productive inflammation, such as decreased vascularity by the thickening of the skin and underlying tissue, loss of color from red to pale blue, induration and infiltration from soft and flaccid to thick and leathery condition under the examining fingers. The foreskin as a whole may be thick, inelastic and leathery, totally irretractible or only retractible with difficulty and cracking along the free margin. The exposed glans is hard and dry, compressed and not set off from the shaft of the penis by a typical corona, which indeed may be almost obliterated. The stage of termination is virtually absent as the disease in relapsing cases may exist for years without relief and with little serious damage beyond the slow sclerosing process. Circumcision may cure such cases as soon as performed, leaving them with the condition

found at the time of operation; but in the neglected persistent cases the process goes on and may even lead to cancer of the glans or foreskin. The subcutaneous infiltration and thickening may in any of these cases be felt between the fingers and must be distinguished from syphilitic infecting balanoposthitis, and early chancre or gumma before ulceration and extension appear.

The discharge has both fluid and detritus as elements, with the latter predominant. Compared with the exudate in acute cases the discharge is much thicker because it proceeds from a much less active process. The modified skin of the cavity of the foreskin is macerated and casts off shreds, patches and slugs of pus, leaving behind indolent excoriations rather than active ulcers. If the cancerous condition is imminent then the maceration and thickening become excrescences with ulceration and discharge.

**Diagnosis and Treatment.**—Proper relations and brevity are fully secured by embracing both these subjects in Chapter II on Complications and Sequels of Acute Urethritis on page 96.

#### **CHRONIC PREPUTIAL FOLLICULITIS.**

**Definition.**—Gonococcal chronic infection of one or more follicles of the foreskin and glans comprises this disease.

**Etiology.**—After an acute folliculitis one or more of these little pockets instead of recovery or destruction passes into chronic inflammation, with sinus and abscess.

**Pathology.**—The process is a continuation of the acute lesions into the chronic manifestations, either as a chronic suppurating and discharging sinus, or as a follicle with its mouth occluded, its pus retained and then discharged, like the spontaneous evacuation of an abscess.

**Symptoms.**—The pain of the retention, the redness of the abscess followed by the discharge or the persistence of the discharge are the subjective signs, while with the probe as objective proof the discharging sinus, abscess cavity or occluded outlet may be found and with the microscope the gonococcus and its allies demonstrated in the pus.

**Diagnosis and Treatment.**—Repetition is avoided by inclusion of these subjects under the acute lesions in Chapter II on Complications and Sequels of Acute Urethritis on page 98.

#### **CHRONIC PARAURETHRAL FOLLICULITIS.**

**Definition, Varieties and Etiology** are the same as detailed under the identical lesions complicating acute urethritis on page 99, with the sole factor of chronic elements added.

**Pathology.**—Pathology is likewise the same in its essence and course but without termination, in that the lesions persist. They are in distribution duplicate of the acute conditions, unilateral or bilateral, single or multiple, and instead of reaching recovery or destruction, continue their process as sinuses, pockets or fistulæ, blind internally, opening externally and usually containing gonococci.

little change and relapsing with periods of intermission and finally as to infection, suppurative and gonococcal and allied germs. Cases curable by circumcision and those not modified by this procedure are also recognized.

**Etiology.**—Etiology is the same as in acute balanitis and comprises malformations of the foreskin, low resistance especially to mucosal disease and the presence of infection from chronic urethritis and of depression from constitutional disease like diabetes. Upon the favorable soil thus prepared a low grade of infection persists and progresses in the persistent type or a more active form of involvement appears and reappears as relapses and remissions in the relapsing type.

**Pathology.**—Such persistent or relapsing chronic inflammation is in the essence of the process the same as similar lesions anywhere else and involves in whole or in part the modified skin covering the glans and lining the foreskin, either superficially or deeply, according to age or activity of process. The tendency is toward thickening, loss of elasticity and recurrence of discharge. The temporary lesions are only those of the subacute process during the exacerbations while the permanent lesions are the chronic inflammation, infiltration, desquamation, retraction and at times deformation and compression of the glans and foreskin through the dense inelastic skin. The associated lesions are the natural abnormality of the foreskin which preceded the lesion and may in turn be augmented by the chronic disease and thus be both cause and complication. The chronic urethral discharge is another allied condition leading to fresh outbreaks and sometimes itself likewise involved.

**Symptoms.**—There is no separation of the disease into invasion, establishment and termination because invasion does not occur unless as part of each relapse and the disease is ordinarily without ending. As in the acute balanitis there is no systemic syndrome. Patients complain of local subjective symptoms, such as intense itching, discomfort, return of the discharge in a relapsing case or continuance of discharge in persistent cases with the usual soreness and odor. They find the foreskin once retractible now irretractible or at best with great difficulty, pain and fissuring and rarely absence of complete erection within the glans proper. The objective symptoms are those of chronic productive inflammation, such as decreased vascularity by the thickening of the skin and underlying tissue, loss of color from red to pale blue, induration and infiltration from soft and flaccid to thick and leathery condition under the examining fingers. The foreskin as a whole may be thick, inelastic and leathery, totally irretractible or only retractible with difficulty and cracking along the free margin. The exposed glans is hard and dry, compressed and not set off from the shaft of the penis by a typical corona, which indeed may be almost obliterated. The stage of termination is virtually absent as the disease in relapsing cases may exist for years without relief and with little serious damage beyond the slow sclerosing process. Circumcision may cure such cases as soon as performed, leaving them with the condition

**CHRONIC LITTRITIS AND FOLLICULITIS.**

**Varieties, Etiology and Pathology** differ in no respect from those already given in the acute forms on pages 106 and 108, but add the development always of the sinus, abscess or fistula as the final stage.

**Symptoms.**—Subjective and objective symptoms, during a period of activity or exacerbation, reintroduce those of the initial acute complication, but during the period of chronic quiescence the discharge is complained of by the patient and the examining finger detects multiple nodes which represent the affected glands as they are distributed along the urethra. The pressure of the finger or of an exploring instrument excites the discharge in which gonococci should always be looked for as a matter of clinical and sociologic importance.

**Diagnosis and Treatment.**—Repetition is avoided and the close relation of acute and chronic littritis and folliculitis emphasized by discussion of their diagnosis and treatment together in Chapter II on Complications and Sequels of Acute Urethritis on page 108.

**CHRONIC COWPERITIS WITHOUT AND WITH RETENTION.**

**Occurrence, Significance and Varieties** are the analogues of those enumerated under the acute complications on page 109, the fewer the symptoms and the more persistent the discharge, the greater the danger of unexpected infection. Thus the chronic catarrhal or suppurating discharge makes cowperitis without retention extremely important.

**Pathology.**—Pathology is sufficiently discussed on page 111 and it may be summed up by stating that the gland is a chronic suppurating pocket if without retention or if with retention an abscess which frequently repeats itself as an acute process. Sinuses and fistulae may be complicating or resulting lesions.

**Symptoms.**—During the period of quiescence, subjective symptoms may be practically absent except the persistent discharge of the gland if without retention, but during the period of activity the patient suffers exactly as in the acute complication, and if retention occurs precisely as in a fresh abscess. Thus there may be an indolent discharge, or an active one in the former case, and in the latter form all the phenomena of severe abscess. The objective signs are on perineal and rectal palpation a thick gland which is more or less incorporated in its annexa by infiltration and from which pus may be expressed if the duct is patent, or an abscess if occluded. The probe will demonstrate sinuses and fistulae, and the bacteriologist the gonococci present.

**Diagnosis and Treatment.**—Both forms of cowperitis show an intimacy in all clinical features between the acute and chronic forms. For this reason the diagnosis and treatment of the chronic stage are combined with those of the acute period in Chapter II on Complications and Sequels of Acute Urethritis on page 112.



**Symptoms.**—After the acute stage has subsided, the subjective signs show absence of full recovery and the presence of constant or intermittent suppuration and discharge in accordance with the presence or absence of occlusion. Objective investigation shows the little sinus, pocket or fistula as already noted, and usually gonococci.

**Diagnosis and Treatment.**—Undue extension of this work is prevented by consideration of both these headings in Chapter II on Complications and Sequels of Acute Urethritis on page 100.

### CHRONIC PERIURETHRAL ABSCESS.

**Definitions, Varieties, Etiology and Pathology** repeat those stated under the acute process on pages 101 and 102, but involve the establishment of a chronic cavity with exacerbations during or independently of the same periods of the chronic urethritis.

**Symptoms.**—Periods of quiescence and activity are noted as in any other chronic abscess. The subjective symptoms during quiescence are sinus, pocket and constant discharge, or leakage after expression or muscular action, and those during activity exemplify acute or subacute abscess with spontaneous or artificial evacuation, exactly as described under the acute complication. There is no true termination in many cases as the disease may discharge throughout life or repeat the cycle of acute attacks. Infection may be indefinitely prolonged. The objective signs verify the foregoing facts described by intelligent patients. Urethroscopy in these cases is very valuable but should not be carried out during acute stages. The clinical importance of these periurethral abscesses cannot be overestimated as sources of infection of the innocent, by gonococci which may persist for years.

**Diagnosis and Treatment.**—The transition from acute to chronic abscess and sinus is so direct that these two topics—diagnosis and treatment—have been combined in Chapter II on Complication and Sequels of Acute and Chronic Urethritis on page 103.

### CHRONIC LYMPHANGITIS AND LYMPHADENITIS.

**Occurrence.**—Lymphangitis and lymphadenitis are hardly ever seen as chronic complications but they may appear somewhat regularly during exacerbations of chronic urethritis, and thus constitute acute complications, but they will need on this account no further discussion than that already given on page 105.

### CHRONIC GLANDULAR COMPLICATIONS OF ANTERIOR GONOCOCCAL CHRONIC URETHRITIS.

**Varieties and Importance** are the same as noted in the Chapter on Acute Complications on page 106, but the essential feature is persistent cavity, sinus and fistula with many relapses within the glands themselves or during the course of temporary return of activity of the urethritis. Littritis, folliculitis and cowperitis are the chief forms.

fistulæ as sequels. The pathologic progress establishes chronic persistence of this folliculitis whether catarrhal or suppurative, and of the abscesses with relapses, retention and repetition of acute phenomena and the establishment of complications and sequels as discussed under the antecedent acute subject on page 116.

**Symptoms.**—Catarrh or suppuration of mild degree is usually the sign of superficial prostatic folliculitis, and the greater the suppuration the more marked the process. Relapse and exacerbation reintroduce the finished picture of the acute process. The local subjective symptoms are sensory, sexual, vesical and rectal and somewhat like the acute but much less distinct and definite. The sensory signs are duller, the vesical symptoms occasional and chiefly under slight direct excitants, the sexual factors absent unless stimulated by the opposite sex, and the rectal elements, chiefly pressure signs as the feces reach the gland and cause discharge of the follicular contents, as mucus, pus and unhealthy prostatic secretion. Definite rectal pain is rare, but discomfort is common. The local objective signs are as in the acute condition, urinary and rectal. The urinary diagnosis with the seven-glass test of the author duplicates the findings described in Chapter VIII on page 455, in that the first three and fifth glasses contain the urethral and prostatic elements, and only the fourth or catheterized glass the normal urine if the bladder is healthy. The sixth and seventh glasses also contain a little prostatic detritus. Laboratory analysis establishes the presence of the gonococci or other organisms, and the prostate as the source of most or all the detritus. Rectal examination displays in follicular prostatitis the gland enlarged, soft as a whole, and rather insensitive, and secures fluid on expression which is rich in prostatic epithelium, pus and unhealthy secretion. On the other hand, in parenchymatous prostatitis the gland is enlarged as a whole or in lobes, tense, soft or fluctuating in accordance with the condition of the abscess, which may be small and numerous or large and generalized. The gland may be reduced in size at one or more points through the destruction of the abscess. The expressed fluid is rich in pus and very scant in prostatic secretion and proves extensive suppuration. The bimanual examination is often employed when the prostate cannot be suitably explored by rectal examination alone in the standing and stooping position and requires for complete determination bimanual investigation. The patient is in the recumbent position with the lower extremities flexed and widely separated and the trunk slightly flexed in order to relax the abdominal muscles. The urethra is irrigated when possible by filling the bladder to distention and allowing the patient to evacuate it, thus cleansing both the posterior and anterior portions of the canal. The bladder is again filled and with the abdominal hand it is slowly but surely depressed toward the perineum and anus, thus carrying downward the prostate which is also explored by the one or two fingers of the other hand well lubricated and passed into the bowel. Any specimen expressed during this examination is collected in a sterilized glass of sterilized water and sent to the laboratory. Asepsis of

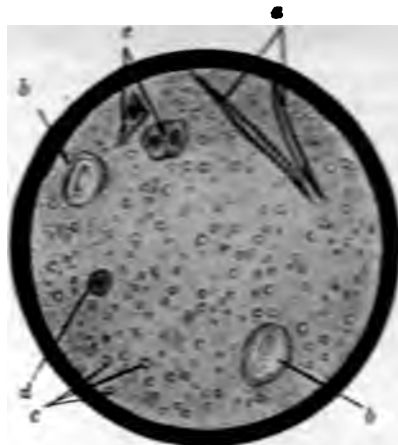
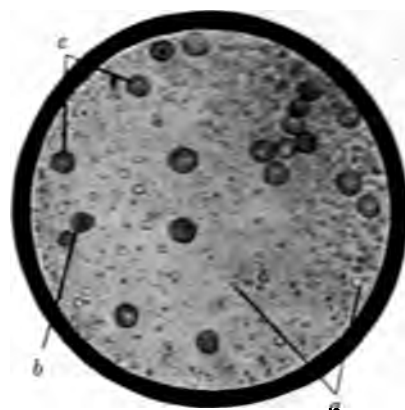
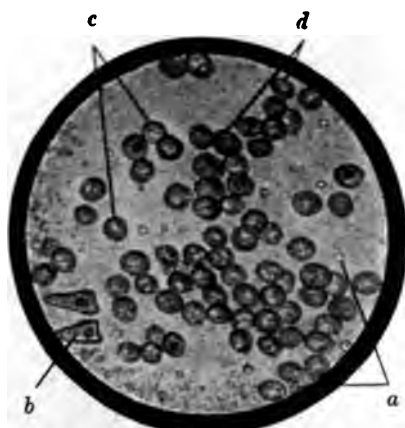


FIG. 76.—Secretion of normal prostate. *a*, spermatozoa; *b*, prostatic bodies; *c*, lecithin bodies. (Lymphocyte  $\times 1,250$  diam.) (After Oberlaender-Kollmann.)



77.—Secretion of mild catarrh of the prostate. *a*, lecithin bodies; *b* and *c*, lymphocytes and leukocytes or pus cells. (After Oberlaender-Kollmann.)



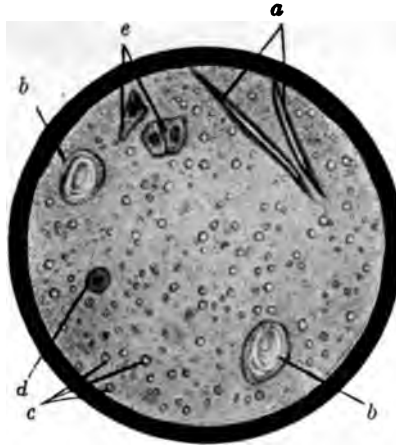
78.—Secretion of severe catarrh of the prostate. *a*, lecithin bodies; *b*, epithelium; *c* and *d*, leukocytes in fatty degeneration. (After Oberlaender-Kollmann.)

*1 Oberlaender-Kollmann: Die Chronische Gonorrhoe, 1910.*

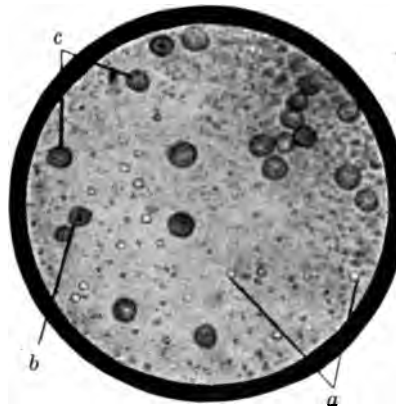


fistulæ as sequels. The pathologic progress establishes chronic persistence of this folliculitis whether catarrhal or suppurative, and of the abscesses with relapses, retention and repetition of acute phenomena and the establishment of complications and sequels as discussed under the antecedent acute subject on page 116.

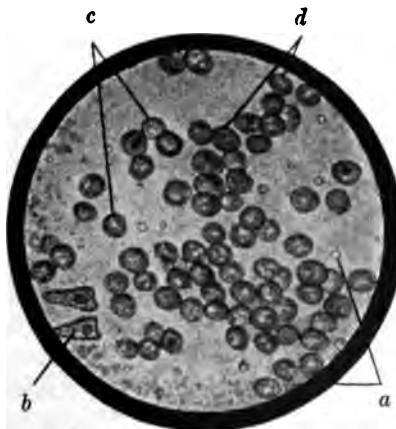
**Symptoms.**—Catarrh or suppuration of mild degree is usually the sign of superficial prostatic folliculitis, and the greater the suppuration the more marked the process. Relapse and exacerbation reintroduce the finished picture of the acute process. The local subjective symptoms are sensory, sexual, vesical and rectal and somewhat like the acute but much less distinct and definite. The sensory signs are duller, the vesical symptoms occasional and chiefly under slight direct excitants, the sexual factors absent unless stimulated by the opposite sex, and the rectal elements, chiefly pressure signs as the feces reach the gland and cause discharge of the follicular contents, as mucus, pus and unhealthy prostatic secretion. Definite rectal pain is rare, but discomfort is common. The local objective signs are as in the acute condition, urinary and rectal. The urinary diagnosis with the seven-glass test of the author duplicates the findings described in Chapter VIII on page 455, in that the first three and fifth glasses contain the urethral and prostatic elements, and only the fourth or catheterized glass the normal urine if the bladder is healthy. The sixth and seventh glasses also contain a little prostatic detritus. Laboratory analysis establishes the presence of the gonococci or other organisms, and the prostate as the source of most or all the detritus. Rectal examination displays in follicular prostatitis the gland enlarged, soft as a whole, and rather insensitive, and secures fluid on expression which is rich in prostatic epithelium, pus and unhealthy secretion. On the other hand, in parenchymatous prostatitis the gland is enlarged as a whole or in lobes, tense, soft or fluctuating in accordance with the condition of the abscess, which may be small and numerous or large and generalized. The gland may be reduced in size at one or more points through the destruction of the abscess. The expressed fluid is rich in pus and very scant in prostatic secretion and proves extensive suppuration. The bimanual examination is often employed when the prostate cannot be suitably explored by rectal examination alone in the standing and stooping position and requires for complete determination bimanual investigation. The patient is in the recumbent position with the lower extremities flexed and widely separated and the trunk slightly flexed in order to relax the abdominal muscles. The urethra is irrigated when possible by filling the bladder to distention and allowing the patient to evacuate it, thus cleansing both the posterior and anterior portions of the canal. The bladder is again filled and with the abdominal hand it is slowly but surely depressed toward the perineum and anus, thus carrying downward the prostate which is also explored by the one or two fingers of the other hand well lubricated and passed into the bowel. Any specimen expressed during this examination is collected in a sterilized glass of sterilized water and sent to the laboratory. Asepsis of



**FIG. 76.**—Secretion of normal prostate. *a*, spermatocrystals; *b*, prostatic bodies; *c*, lecithin bodies; *d*, lymphocyte; *e*, pus cells. (After Oberlaender-Kollmann.<sup>1</sup>)



**FIG. 77.**—Secretion of mild catarrh of the prostate. *a*, lecithin bodies; *b* and *c*, lymphocytes and leukocytes or pus cells. (After Oberlaender-Kollmann.)



**FIG. 78.**—Secretion of severe catarrh of the prostate. *a*, lecithin bodies; *b*, epithelium; *c* and *d*, leukocytes in fatty degeneration. (After Oberlaender-Kollmann.)

<sup>1</sup> Oberlaender-Kollmann: *Die Chronische Gonorrhoe*, 1910.

the specimen requires washing the glans and meatus also. If no specimen is desired the detail of irrigating the urethra may be omitted.

The systemic subjective and objective symptoms are less marked than those of the acute complication, and are summed up in feverishness and malaise. During exacerbations, however, there is not the slightest distinction between the chronic and the acute except that chronic cases have a tendency toward periprostatitis and infiltration. Even partial urethral obstruction through the edema and the swelling may be present.

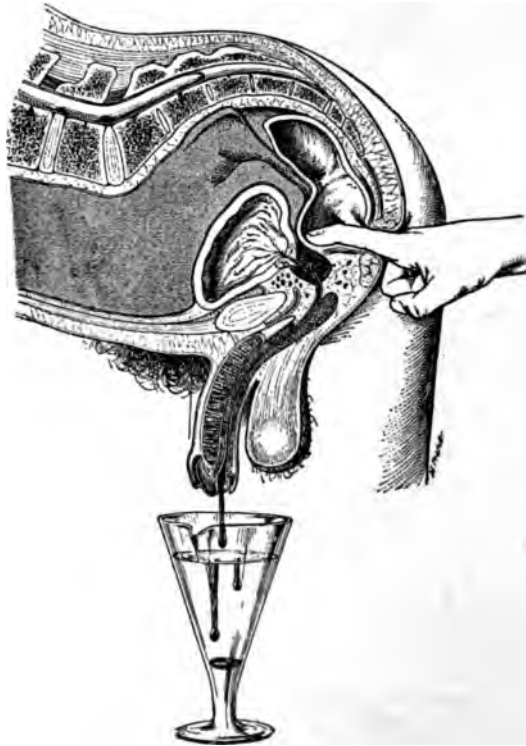


FIG. 79.—Massage of the prostate for excretion of its secretion. The prostatic secretion is collected in a sterile glass which has been half filled with sterilized water. The penis should be washed with mild antiseptic and the anterior urethra irrigated so that as far as possible the specimen shall be that of the prostate. The flakes of pus vary as to their nature and are described in the Chapter of Diagnosis. (Luys.<sup>1</sup>)

In a broad sense chronic, follicular prostatitis and parenchymatous prostatitis are important and persistent conditions, sociologically, clinically and surgically, through the embryological structure, adult physiological function and direct relation of the gland with the posterior urethra which may in itself be so commonly the seat of gonococcal chronic lesions.

<sup>1</sup> Loc. cit.

**Diagnosis and Treatment.**—Chronic prostatitis of both the follicular and parenchymatous forms is a very vast subject and so closely related in all respects with the acute manifestations that directness of discussion required consideration of the diagnosis and treatment of chronic prostatic lesions with acute forms in Chapter II on Complications and Sequels of Acute Urethritis on page 119. On the other hand, however, the work of Young, Geraghty and Stevens<sup>1</sup> is probably the best study of this subject whose chief conclusions should always be remembered.

These authors compared normal and pathological secretions, obtaining specimens after rectal massage, either with free flow or more or less mixed with contents of the bladder. Precipitation and centrifugation were employed. Separation of prostatic and vesicular secretions was not done after the method of the author's seven-glass test, discussed on page 455. Normal secretion is a combined fluid, whitish or yellowish, thick, turbid, opalescent, homogeneous and viscid from the prostate. The vesicles add semisolid strings and slugs. The reaction is faintly alkaline to litmus, but acid to phthalein. Microscopically in predominance are lecithin, columnar epithelium, granules and corpora amylacea and scattered numbers of spermatozoa, mucin globules, red blood cells and white blood cells. The lecithin appears in small or large granules, never over the diameter of red blood cells. The latter occur in masses through disease or traumatism of the examination. Leukocytes are absent in normal secretion. Finger and Posner<sup>2</sup> were early in emphasizing careful frequent examinations combined with rectal palpation. Goldberg<sup>3</sup> states that the secretion is conclusive in doubtful rectal examination, a fact repeated by Notthafft.<sup>4</sup> The secretion is much more important than the rectal conditions, and pathological elements such as pus may not be present, except after from two to five massages. Urethral pus must be excluded as indicated by Gassmann.<sup>5</sup> Young's method of obtaining specimens rests on a full bladder, a three-glass evacuation, thorough prostatic massage and collection of the specimen at the meatus. Another urination is attempted or irrigation performed if the specimen does not present at the meatus. The product is centrifuged. Pus in the urethra indicates irrigation. Young's four steps should be preceded by the author's seven-glass test, described on page 455, in order to minimize error, and consist in macroscopic, microscopic, staining and culture examinations. The gross color is yellowish, reddish, greenish, milky white or clear. Schlagintweit's method of dripping the secretion into a glass of water is already noted on page 120. The microscopic findings show leukocytes and pus cells mixed with normal elements. The pus predominates in inverse ratio to the normal elements and proportional with the disease. Bering<sup>6</sup> says that leukocytes of prostatitis are smaller,

<sup>1</sup> Johns Hopkins Hospital Reports, xiii, 1906.

<sup>2</sup> Rothschild: Deut. med. Woch., 1900.

<sup>3</sup> Abstract in Monatsberichte f. Urol., 1901.

<sup>4</sup> Archiv. f. Derm. u. Syph., 1904.

<sup>5</sup> Centralb. f. d. Krank. d. Harn. u. Sex. Org. Bd. xv.

<sup>6</sup> Archiv. f. Derm. u. Syph., 1905.

peculiarly granular and chiefly mononuclear in comparison with those of urethritis. Bonn<sup>1</sup> claims that small prostatic epithelia guarantee the source of the leukocytes, and Bering claims that chronic prostatitis decreases the number but increases the size of corpora amylacea. Fuerbringer, quoted by Young, reported revival of inactive spermatozoa during favorable treatment and Schlagintweit found that the addition of prostatic fluid to seminal vesicular secretion secured such revival. Young prefers Wederhake's method of staining for the ordinary specimen, and blood stains for distinction of the leukocytes. He believes that the diagnosis of chronic prostatitis rests on rectal palpation and examination of the secretion. Young does not give suitable weight to urethroscopy in this field, nor fitting warning against the results of traumatism of the prostate by improper massage. The writer has seen prostatic massage done so violently that acute inflammation would certainly follow if the parotid gland or the testicle or the ovary were similarly manipulated. Misleading results must follow such injudicious effort. Young's conclusions as to bacteriology may be abbreviated as follows: 1. The urethroscope preceded and followed by irrigation and associated with cultures is a valuable detail; 2. shreds in the first glass do not vitiate the bacteriology. Positive results are more frequent without shreds. 3. Bacteria are not frequent in chronic prostatitis under treatment. 4. Multiple infection is not unusual, and the same patient may have different organisms at several examinations, requiring great judgment. 5. Bacteria may occur in nongonococcal cases. 6. Frequency and persistence of gonococci are not yet settled. 7. The value of case reports in literature depends on the method used. 8. Smears for bacteria are valuable only if secured under full precautions.

Young's summary is very important, and is as follows: 1. Pus is present in practically all chronic prostatitis, especially later than the second massage. The microscope is necessary for accuracy. Polymorphonuclear neutrophiles predominate, but Bering finds mononuclears. 2. The amount of pus bears direct relation to the prostatitis, but mild cases may have much and severe cases little pus. 3. Pus decreases usually with treatment, but more marked progress may follow rest from treatment. 4. Normal are in inverse ratio to pus elements, but as yet without definite diagnostic or prognostic value. 5. Staining is of value for bacteria only. 6. Pus seems to bear no direct relation with the activity of spermatozoa, but treatment revives them. 7. Reaction to litmus is nearly always alkaline.

#### **CHRONIC SEMINAL VESICULITIS OR SPERMATOCYSTITIS.**

**Occurrence.**—Chronic involvement of the seminal vesicles is a much more common occurrence than was at one time supposed. Many of the older works discuss the complication in a more or less casual and

<sup>1</sup> Prager. med. Woch., 1893.

fragmentary manner. The well-recognized work, however, of Fuller,<sup>1</sup> and later of Young<sup>2</sup> in this country, has proved beyond all question its frequent incidence and far-reaching possible results. It is necessarily more common in chronic than in acute urethral infection.

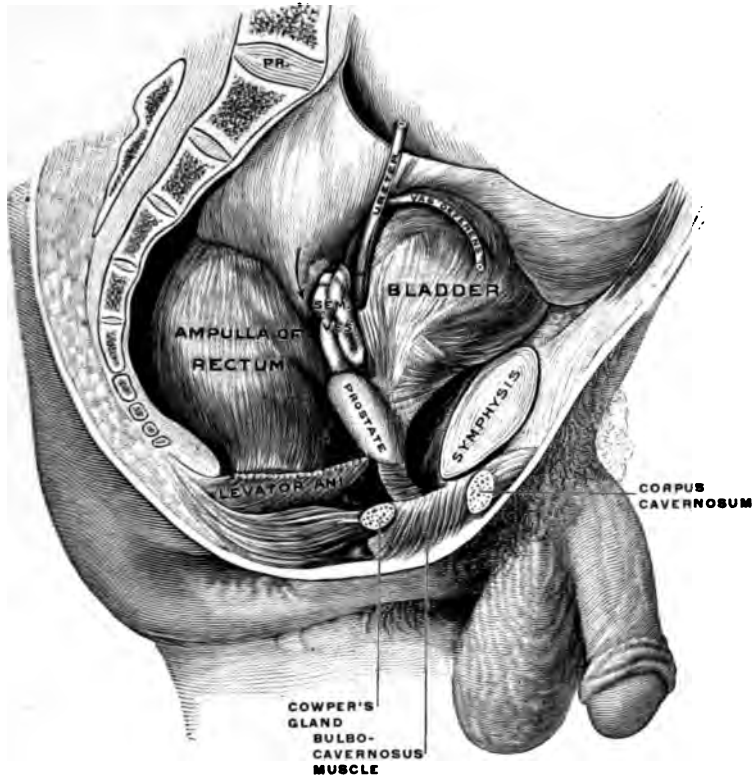


FIG. 80.—Male pelvic organs seen from right side. Bladder and rectum distended; relations of the peritoneum to the bladder and rectum are clearly shown. The arrow points to the rectovesical pouch.<sup>3</sup> (Corning.)

**Etiology.**—Etiology establishes the same exciting and predisposing causes as in the acute. The most important contributing factor is sexual excess in masturbation or coitus, during a posterior chronic urethritis, especially of progressive and relapsing type. From the foci already precedent and active in such a urethritis the gonococci extend by direct contiguity along the ejaculatory ducts, themselves congested as the result of such indiscretions.

**Varieties.**—Varieties contribute no addition to those discussed under acute seminal vesiculitis, but the important ones are the fundamental types: spermatoecystitis with occlusion and without occlusion of the

<sup>1</sup> Tr. Am. Urol. Assn., iii, 344; Ibid., vi, 274; Med. Rec., January 23, 1915.

<sup>2</sup> Tr. Am. Assn. Gen.-Urin. Surg., 1912, vii, 73.

<sup>3</sup> Gray's Anatomy, Lea & Febiger, Philadelphia, 1918.

ducts, which really embrace all other forms. Tuberculosis of the seminal vesicles is not a part of this work except for differentiation. Primary and secondary seminal vesiculitis have also been previously discussed, the former as exemplified chiefly by tuberculous, and the latter by gonococcal and allied pyogenic infection. Catarrhal seminal vesiculitis is either the expression of sexual excess or the terminal sign of the gonococcal form.

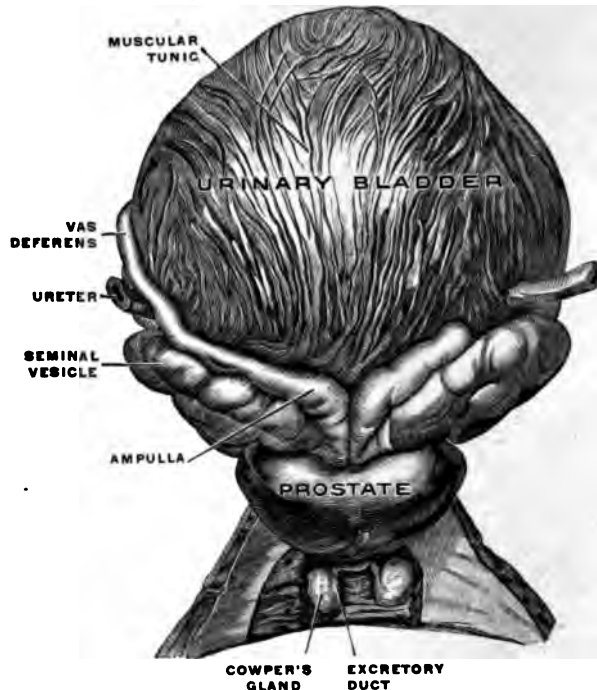


FIG. 81.—The urinary bladder, distended, with surrounding structures, viewed from behind. (Spalteholz.)

**Pathology.**—Pathology must respect the two forms of spermato-cystitis, without and with retention. After the stages pictured for acute pathology on page 127, one finds in chronic seminal vesiculitis without retention extensive and deep desquamation of epithelium, purulence, small cell infiltration, sclerosis, patency of the duct which imitates these findings and discharges into the urethra. Chronic spermato-cystitis with retention reveals a duct closed by infiltration and stricture of its walls followed either by an indolent accumulation and later evacuation of pus, or a temporarily active accumulation and discharge; in other words, subacute abscess or relapsing acute phlegmon with all the pathogenesis as described on page 130. Furthermore, the abscess may have developed the sinuses and fistulæ noted under the acute complication as having perineal, vesical, rectal and very rarely peritoneal outlet.

<sup>1</sup> Loc. cit.



Thomas<sup>1</sup> gives Fuller<sup>2</sup> and Lloyd<sup>3</sup> credit as pioneers in this field and quotes Picker<sup>4</sup> as having in 1911 before the III Congress of the German

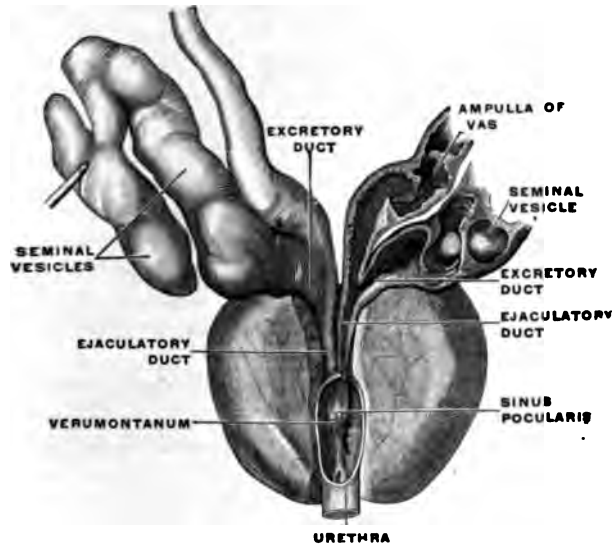


FIG. 82.—The ejaculatory ducts viewed from in front and above.<sup>5</sup>

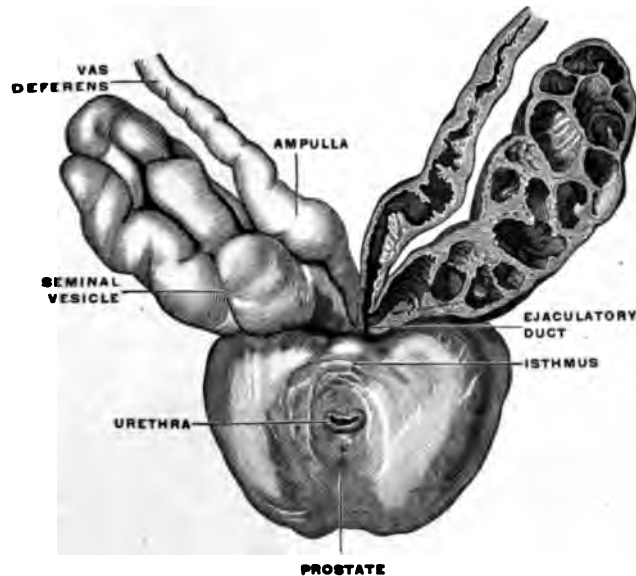


FIG. 83.—Prostate with seminal vesicles and seminal ducts viewed from in front and above.<sup>6</sup>

<sup>1</sup> Tr. Philadelphia Acad. of Surg., xvii, 21.

<sup>2</sup> Jour. Am. Med. Assn., May 4, 1901, p. 1228; New York Med. Rec., October 30, 1909; Jour. Am. Med. Assn., November 30, 1912, p. 1959.

<sup>3</sup> British Med. Jour., April 20, 1889, p. 882; Lancet, 1891, ii, 975.

<sup>4</sup> XIV International Medical Congress, London, 1913.

<sup>5</sup> Gray's Anatomy, 19th ed., 1913.

<sup>6</sup> Ibid., 20th ed., 1918.

Urologic Society presented a classic study of about 150 seminal vesicles dissecting out the tube systems after injecting the vasa deferentia with bismuth paste, as follows: "From the material comprising 56 normal and 16 pathological specimens, he makes the following anatomical classification: (1) simple straight tubes; (2) thick twisted tubes with or without diverticula; (3) thin twisted tubes with or without diverticula; (4) main tubes straight or twisted with larger grapelike arranged diverticula; (5) short main tube with large irregular ramified branches; (6) miscellaneous, comprising (a) embryological abnormalities and (b) pathological conditions. Of the normal specimens about one-third belong to types (1), (2) and (3) and two-thirds to (4) and (5). The lengths of the various vesicles measured from 6 to 23 cm.; the capacities varied from 3 to 11.5 c.c. Thus it is seen that the seminal vesicles of the male urethra possess the most extensive secretory surface with the worst drainage."

**Symptoms.**—As in pathology the two basic classes of case must be regarded. Chronic seminal vesiculitis without retention is probably a much more common condition than ordinarily recognized, because the drainage causes few subjective symptoms and leaves only objective proof which is not easy. The case is, therefore, casually diagnosed as one of posterior chronic urethritis whereas this complication is really the prevailing element. Its local subjective symptoms are sensory, urinary, urethral, rectal and sexual, exactly as enumerated for acute cases but they are masked, undefined and relatively indifferent. The sensory signs are discomfort and uneasiness rather than pain; the urinary function is little disturbed except in increased frequency; the urethral condition shows a constant discharge of rather large mucous masses and strings; the rectal factors are absent or very slight, excepting alone expression of semen during defecation, and the sexual details are undue stimulation probably through the inability of the sac to hold the semen. Thus coitus increases the discharge and the disturbance and this weakness of the sacs leads to very frequent nocturnal emissions of which the patients greatly complain.

The local objective symptoms recognize the anatomy as given in previous pages, occur on one or both sides equally or differently and comprise chiefly enlargement and prominence, thickening and sclerosis, thickening and bogginess, practical absence of tenderness and free expression of the characteristic shreds and pus. Urinalysis after the author's seven-glass test, which is described on page 455, shows few shreds in the first two or anterior urethral glasses, the classic slugs or strings of pus and mucus in the third or posterior urethral glass, normal urine in the fourth or bladder glass, prostatic elements in the fifth glass and extraordinary masses of shreds, slugs, strings, mucus and pus in the sixth and seventh glasses from the two vesicles. With the prostate normal these facts establish the diagnosis but bacteriological and microscopic investigation are required for detection of the organisms and the distinction between prostatic and spermatocystic products.

The systemic subjective and objective symptoms are the same in character, less in degree but greater in absorption elements than seen in acute cases. Similar and more frequent sequels, especially arthritis, as the best example, are common experience. To this class belongs urinary and urethral chill excited by the examining finger and should never be an unexpected condition.

The symptom-complex of chronic spermatoecystitis with retention reiterates all the foregoing indolent conditions but adds the presence of abscess without or within the cavity of the sac. Such abscess is chronic and persistent or acute and subacute with relapses. Examination during an acute exacerbation adds no feature to those portrayed for acute varieties. Systemic absorption, however, is in greater or less



FIG. 84.—Chronic seminal pyovesiculosis. Fifty minims of collargol injected into each side, great enlargement, irregularity and tortuosity are shown. (Thomas and Pancoast.)

degree almost universal, and the complications of this condition although itself a complication are the same as those stated under the same subject. The same rule applied to the stage of termination with emphasis on the facts of absorption and in many of no recovery whatever in the true sense in that one or both vesicles are permanently damaged or even destroyed.

**Significance.**—In summarizing their studies, Thomas and Pancoast<sup>2</sup> give the following conclusions:

1. Chronic seminal vesiculitis is more prevalent than realized and possesses confusing and varied symptoms even remote from the

<sup>1</sup> Loc. cit.

<sup>2</sup> Loc. cit., p. 26.

urinary tract. Infection is invariably mixed, from which in chronic forms the gonococcus is almost impossible to isolate.

2. The disease is analogous to pus tubes in the female with similar serious and difficult problems of treatment without as yet full acknowledgment by the profession.

3. Treatment must be selected according to anatomy and pathology of the particular vesicles, ejaculatory ducts and vasa deferentia, usually determined by proper rectal examination, massage and laboratory diagnosis, supplemented by vasopuncture and collargol radiography.

4. Experienced persistent massage will cure most patients in time. When ineffectual, vasopuncture and vasostomy afford direct medication; but when these fail, vesiculotomy or even vesiculectomy alone avails.

5. Bilateral vasopuncture and collargol medication have resulted in at least temporary cure of persistent cases.

6. "Collargol radiograms in a series of normal and pathological cases have demonstrated, (a) by comparison *in vivo* and *in vitro*, graphic portrayal of an ejaculatory duct sphincter; (b) the intimate relationship between the ureter and the seminal vesicle, whereby urethral irritation and urinary obstruction may occur in the event of an enlarged and inflamed vesicle; (c) the presence of stricture or obstruction of the vas; (d) congenital anomalies of the vesiculæ seminales; (e) inflammatory enlargements, especially loculated collections of pus or seminal pyovesiculosis."

**Diagnosis and Treatment.**—For the sake of impressing the direct transition from the acute to the chronic forms and their otherwise close relation, consideration of chronic involvement as to diagnosis and treatment is embodied with that of the acute stages in Chapter II on Complications and Sequels of Acute Urethritis on pages 131-4.

### EPIDIDYMITIS, ORCHITIS AND FUNICULITIS.

**Occurrence.**—Like the acute forms this series of complications, most intimately related to each other, is one of the most common chronic complications of chronic urethritis. This fact gains, perhaps, too little respect for the infiltrations, nodules, strictures and occlusions of the vas and epididymis which may be life-long.

**Varieties.**—The gonococcal is again the chief form as to cause, while the classes as to occurrence, location and association remain the same as in the acute, which the chronic merely supersedes. Nongonococcal chronic epididymitis probably does not occur but complex infections with the gonococcus as the most potent invader are, of course, frequent. Tuberculous epididymitis does not concern these pages.

**Etiology.**—Etiology is a perspective of the acute lesions and brings out as the systemic predisposer low resistance to disease in general. The local inviting factors are, of course, posterior chronic urethritis with complications in the prostate and seminal vesicles—all being involved by direct continuity of mucosa and by intimate physiological function. Acute epididymitis is always the antecedent.

Local exciting factors are exemplified fully in Chapter II on page 147, but should emphasize trauma and sexual excess as the means of lowering resistance.

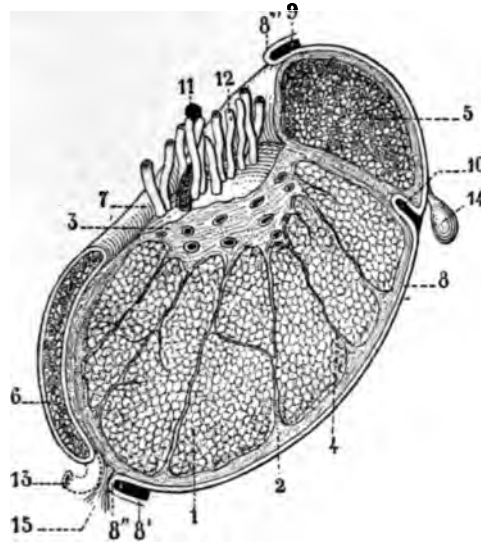


FIG. 85.—Sagittal section of the left testicle. External segment of the specimen. 1, acinus; 2, albuginea; 3, corpus of Highmore; 4, interlobular septula extending from the corpus of Highmore to the albuginea; 5, head of the epididymis; 6, tail of the epididymis; 7, body of the epididymis not divided by the section; 8 and 8', visceral and parietal layer of the vaginalis; 8'', fold of the two layers; 9, cavity of the vaginalis; 10, subepididymal cul-de-sac; 11, spermatic artery; 12, veins of the cord; 13, vas deferens in dotted lines because it is internal to the line of section; 14, hydatid of Morgagni; 15, scrotal ligament of the testicle. (Testut.)

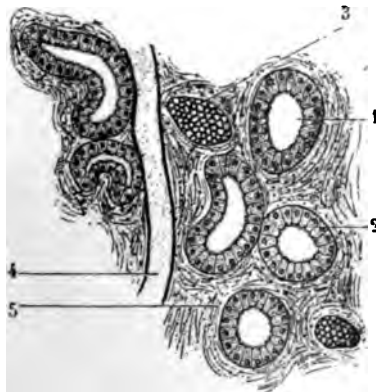


FIG. 86.—Transverse section of the epididymis. 1, transverse section of seminiferous tubules; 2, cylindrical epithelium with vibratile cilia; 3, transverse section of bloodvessels; 4, longitudinal section of bloodvessels; 5, connective-tissue bed between the seminiferous tubules. (Schenk.)

<sup>1</sup> *Traité d'Anatomie Humaine*, 6th ed., No. 4.

<sup>2</sup> *Ibid.* (after Schenk).

**Pathology.**—Pathology was in the acute lesion shown in essence to be exfoliation as the leading and infiltration as the subordinate factor, but in the chronic, this relation is reversed. There may be exudate comprising chiefly unhealthy infectious semen mixed with detritus and comprising the temporary lesion, but the infiltration, nodulation, stricture and occlusion of the vas and epididymis at any or many points complete the permanent lesions. These are found chiefly in the globus minor where the ducts have been gathered into a single tube, next in the immediately contiguous vas and finally in the globus major of which part may escape through multiple tubules. The associated lesion of hydrocele is usually absent unless an exacerbation is present which will duplicate all the other pathology of an acute lesion.

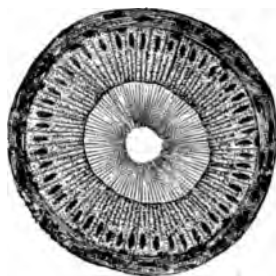


FIG. 87.—Transverse section of epididymal canal. The wall of the canal is made up of a thick layer of smooth muscle fibers, within which is a layer of columnar epithelium cells with extraordinarily long vibratile cilia projecting into the lumen of the canal. (Klein.)

**Symptoms.**—Symptoms represent the terminal stage of the acute lesion but are indifferent, not active manifestations, showing two types, indolent persistent and progressive relapsing. The local subjective symptoms decrease so that discomfort replaces pain, except of neuralgic and spasmodic type, due perhaps to progress of exudate and secretion through a strictured point. Tenderness is less, and weight moderate or even marked and heat is absent. The local objective symptoms likewise diminish; tenderness and likewise enlargement are much less except at the nodes. Heat, edema and hydrocele do not occur in the quiescent form but may light up during a relapse. Discharge is not affected as in the acute lesion unless an exacerbation is under way; in other words, the chronic epididymitis permits the posterior chronic urethritis to manifest its own symptoms. The systemic subjective and objective symptoms are of little moment except the neuroses, which may be troublesome to patient and practitioner. When the other systemic signs are prominent they are rather due to such associates as chronic seminal vesiculitis and prostatitis. The reverse rule, however, is followed during a relapse, which is really another acute attack.

<sup>1</sup> *Traité d'Anatomie Humaine*, 6th ed., No. 4, (after Klein).

In terminating, complete resolution is often seen even after prolonged attacks, but more frequently infiltrations, nodulation, strictures and contractures in moderate or severe degree and in single or multiple occurrence are the outcome. The clinical importance and the physiological damage of chronic epididymitis are sharply foreshadowed in the remarks under acute forms and need no repetition.

**Diagnosis and Treatment.**—Of these two headings of the subject of chronic testicular involvement are combined with those of corresponding acute lesions, for the sake of brevity, in Chapter II on Complications and Sequels of Acute Urethritis on pages 153–7.

## 2. Urinary Forms.

**General Considerations.**—After a posterior acute urethritis has passed into the chronic stage, particularly with complications and exacerbations, it may pass the sphincter and reach the urinary organs of itself or through incidental causes and thus provoke one of the following complications: urethrocystitis, cystitis, ureteritis, pyelitis and pyelonephritis, which may extend from one to the other region in a most active and complex process.

**Etiology.**—The predisposing and exciting factors have already been duly narrated on pages 163 and 166. Emphasis should rest, however, on the basis of proximal extension of the disease—exacerbations which seem to occur in subjects with catarrhal diathesis and low-grade resistance. The frequency of instrumentation of the urethra and bladder in chronic urethritis makes direct infection common and important. The gonococcus is the most frequent and typical organism.

## CHRONIC URETHROCYSTITIS.

**Definition and Varieties** need not be discussed further than they have been on page 163. The distribution of the lesions is also the same.

**Symptoms.**—Symptoms are characterized by the subsidence of the acute suffering and persistence of the vesical damage so that the organ functionates imperfectly. The local subjective symptoms are almost solely frequency of urination and terminal pus, whereas tenesmus, pain, blood and retention are almost absent or very greatly decreased. An exacerbation may light up all the symptoms of a fresh acute attack. The local objective symptoms are best shown by the five-glass test. The anterior and control urethral glasses depend on the condition of the anterior urethra which if comparatively normal will give rather clean specimens. The posterior urethral glass will be turbid. The bladder or catheterized specimen will be turbid, especially at the last few drops and the massage specimen secured with a bladder distended with boric acid water will usually give the products of a complicated posterior urethritis.

The termination is full recovery in a few mild cases without damage to the floor of the bladder. Restitution occurs in most cases leaving a bladder somewhat defective and a third group show no recovery in



the strict sense, in that chronic, local or general cystitis with tendency to weakness and irritability, and even exacerbations of acute inflammation continue through life. Slow extension from such a bladder to infection of the ureters and kidneys must not be forgotten, as the true final stage.

**Diagnosis and Treatment.**—In the diagnosis, in addition to the standards of careful history, physical examination, laboratory and blood tests and treatment, decision rests firmly on a careful urethrocystoscopy. The differential points elicited by this investigation are given in Chapter II on this subject and should therefore not be repeated here.

As to the treatment of the chronic lesion, little may be added to the enumeration and discussion of the principles and means laid down in Chapter II on Complications and Sequels of Acute Urethritis on page 166, in which are combined the diagnosis and treatment of both acute and chronic forms.

### CHRONIC CYSTITIS.

**Definition, Varieties and Etiology** offer no comments other than those given for the acute lesion on page 166.

**Pathology.**—Pathology in essence, involvement, microscopy and temporary lesions stands unchanged from the description under acute cystitis on page 167. The permanent lesions, however, are in the chronic disease all important and comprise hypertrophy, trabeculations, sacculations, deformity and chronic inflammation—localized, disseminated or general. The hypertrophy is due to the incessant strain and spasm of the muscle and may pass into well-established atrophy. Trabeculations arise from undue development of various muscle bands which resist the atrophic process, which goes on, however, between them, thus leading to sacculations whose weakening and dilatation may even reach the limit of hernia of the bladder wall. Deformity and contracture follow when atony does not take place. Chronic inflammation is exemplified by universal purulence and exfoliation or the same processes in few or many foci. The complicating lesions of ascent into the renal zone are much more common than in acute cystitis.

**Symptoms.**—Symptoms are barren if the acute subjective signs are as given unless a fresh outbreak is present. General depreciation and septic absorption may, however, attract attention and suggest the added factors of renal involvement. The cardinal local subjective symptoms of pollakiuria, tenesmus, dysuria, pain and blood are all decreased and some may be absent. Painful frequency varies with bodily weariness and errors in diet and the amount of pus decomposing on the floor of the bladder. Tenesmus is moderate if the bladder really empties itself, but residuum in cases with prostatic hypertrophy sacculations and atony may excite it severely. The cardinal local objective symptoms are likewise altered. Tenderness is absent as the bladder may be palpated and percussed in its thickened enlarged state above the symphysis or be beyond reach in its contracted for

below it. Pyuria is always marked and characteristic, and hematuria occasional except in ulcerating cases. The five-glass test should always be performed and gives characteristic revelations; the massage glass, however, can be successfully secured only after irrigating the bladder thoroughly and distending it with boric water. Cystoscopy is the final and absolute objective analysis of the case and is fully described in Chapter XIII on page 761. The termination is as briefly outlined under the subject of urethrocystitis but apt to be more severe and prolonged because of the universal involvement of the viscus and for the same reason extension to the kidney is much more common, and therefore the complications of chronic cystitis, itself a complication, are ascent of the infection causing ureteritis, pyelitis and pyelonephritis.

**Diagnosis.**—The history affords an acute attack with all the salient subjective and objective systemic symptoms declining or absent. The laboratory reports abundant sediment in the urine of vesical origin, as proved by the catheter, which eliminates the urethra, prostate and seminal vesicles as sources. The five-glass test shows purulence of the bladder in the fourth or bladder glass. The distinction between turbidities due to pus, carbonates and phosphates is tabulated according to Ultzmann under acute cystitis on page 170. Final diagnosis, however, of chronic cystitis rests on the use of the cystoscope. The reader is referred to the Chapter on Cystoscopy for determination of the various varieties—nonsuppurative and suppurative, membranous, ulcerative and necrotic, neoplastic, calcareous, tuberculous, colon bacillary and finally regional, disseminate and general.

Modern diagnosis exemplified in cystoscopy, ureteral catheterization, functional renal tests and the like renders the incidence of these complications in chronic form much less frequent, as operative treatment intervenes as soon as it is obvious that the affected kidney is definitely involved or of no value.

**Treatment.**—Chronic cystitis is a vast subject and all the relations and variations of treatment cannot be discussed fully except in a monograph on the subject itself. The principles and the means of treating it are the same as those of acute cystitis. For exemplification of the intimacy between acute and chronic cystitis, therefore, the diagnosis and treatment of each are combined in Chapter III on Complications and Sequels of Acute Urethritis.

### CHRONIC URETERITIS, PYELITIS AND PYELONEPHRITIS.

**Occurrence.**—These lesions in their chronic forms usually appear more or less in association and very rarely individually as in the acute stages. Thus they commonly form one clinical feature in which, however, the kidney element may be least in some but most important in the average case.

**Definition and Varieties** are clearly stated in the description of the acute lesions, on page 177, which may be regarded as always precursory of the chronic.

**Etiology.**—Etiology adds nothing to the portrayal of acute causes but the bloodstream and lymphchannels become more important avenues of invasion than in the former group, as it is likely that mixed infection, which is so common, especially with the *Bacillus coli communis*, does not occur excepting through one of these routes.

**Symptoms.**—Symptoms display the picture of acute forms in a frame of low-grade condition. Without pyelonephritis chronic ureteritis and pyelitis as persistent individual lesions probably do not occur except in relapsing form which is then really a series of frequent acute and subacute attacks. Chronic pyelonephritis ensues after the subsidence of an acute attack, whose symptoms continue in masked or marked intermittent form with low-grade septic state, anemia and emaciation not unlike tuberculosis in general effect. The types of acute are not changed and include ascending and descending infection either with or without occlusion of the ureter. The local subjective symptoms without occlusion are mild with relapses because the purulence drains steadily into the bladder, but with occlusion the symptoms are more pronounced or even severe. Pain, oliguria and anuria occur. The pain is dull and dragging on one or both sides. Oliguria appears only during exacerbations if the normal kidney is performing full function, an anuria is usually absent unless a fresh extension or involvement of the normal kidney supervenes. The local and systemic objective signs are the persistence of feverishness, infection, sickness and prostration. Palpation frequently reveals a typical mass in the renal zone posteriorly and anteriorly and may be followed by sudden increase in pus in the bladder in cases without occlusion and by considerable disturbance in cases with occlusion. Urinalysis reports usually alkaline urine from mixed infection and decomposition in cases whose ureters are patent but, if occluded, the urine contains the elements of the antecedent cystitis and perhaps ureteritis. Normal urine may even occur if the bladder has recovered or a good kidney may excrete at times the urine of acute congestion scanty, high specific gravity, deficient in numerous various casts and albumin, for a few hours or days. Separated specimens by ureteral catheterization should always be secured and examined and in draining cases will show pus and mucus in strands and flakes, blood cells, kidney elements, bacteria especially after palpation and in occluded cases will show no urine or a few long strands of mucus. Ureteral catheterization in patent ureters secures a specimen from the diseased side whose analysis is that just stated and from the normal side either healthy urine or that of temporary renal congestion. Impervious ureters accept catheters for only a few centimeters, will bring away strings of mucus and pus on withdrawal. Renal efficiency tests are paramount and give from the healthy side at times extraordinarily high readings showing a perfectly acting organ and from diseased side either no result at all or a much decreased and delayed output or even a temporarily high efficiency. In this connection computation of the total urea output of both kidneys during the several periods of test and other elements of urinalysis will interpret seemingly anomalous results.

The termination is regularly toward destruction of the kidney in part or in whole, through true multiple abscesses or a single generalized phlegmon. Foci near the surface of the kidney frequently rupture into the perirenal fat and then induce extensive lumbar abscesses, or without this result bind the kidney with dense adhesions. Unless the kidney is removed there is a slow absorptive sepsis, depreciation of health and finally breakdown of the opposite kidney. Very rarely, however, Nature brings the process to an end on the affected side by walling it off in a more or less cystic condition. Death occurs either from the slow sepsis or bilateral nephritis.

**Diagnosis.**—Chronic ureteropyelorenal lesions are direct transition from the corresponding acute forms. All the elements of diagnosis discussed under the latter subject apply to the chronic lesions and in particular is the employment of cystoscopy necessary with its adjuncts of urinary separation by ureteral catheterization, functional test, refined urinalysis and x-ray.

**Treatment.**—Chronic lesions of the kidney, its pelvis and ureter do not lend themselves to successful medicinal treatment, although relapses and recrudescences may be controlled by this means. Surgical measures are apt to be first choice in marked cases. All the principles of treatment apply to the chronic kidney disease laid down for the acute form in Chapter II on Complications and Sequels of Acute Urethritis on page 188.

### CHRONIC RETENTION OF URINE.

**Definition and Occurrence.**—Chronic complete retention of urine cannot occur without death of the patient, but chronic partial retention with exacerbations of acute or subacute retention is very common. It may be denominated relapsing retention as indicated under the acute lesion, and is seen most frequently in the obstruction due to stricture of the urethra with its great difficulty of urination and in that due to enlargement of the prostate with its residual urine.

**Etiology** denominates this as a very common sequel of gonococcal chronic urethritis in association with stricture and prostatic involvement. Mild excitants produce the relapses of total obstruction. The other causal factors are narrated under the description of acute retention on page 197.

**Symptoms.**—Symptoms in addition to those described for stricture of the urethra on page 343 and prostatic hypertrophy on page 943, comprise the details already given for the acute manifestations.

**Diagnosis and Treatment.**—Nothing can be added to the general subject of diagnosis and treatment as given in Chapter II on Complications and Sequels of Acute Urethritis on page 198.

**Cure.**—In the matter of persistence of the gonococci in the prostate in its personal and social prophylactic relations one of the best studies is that by Saxe,<sup>1</sup> who draws the following conclusions:

<sup>1</sup> Tr. Am. Urol. Assn., 1909, iii, 131.

"1. Thorough irrigation of the urethra before massaging the prostate is essential in order to exclude contamination of the prostatic secretion by pus and bacteria from the urethra.

2. Injections of fifteen drops of a 1 per cent. solution of silver nitrate into the urethra twenty-four to forty-eight hours before prostatic massage sometimes reveal gonococci, when other means have failed.

3. A double stain of eosin and methylene blue in pure methyl alcohol, after the manner of the well-known blood-stains, is excellent in the morphological study of prostatic smears. Gram's stain is essential, but is misleading unless properly applied.

4. Cultures, while desirable, are often unsuccessful, owing to the capricious character of the gonococcus. Negative cultures are not conclusive.

5. Of 180 cases of chronic gonorrheal infection 60 per cent. showed prostatitis. The older the infection, the more frequent the prostatitis.

6. Of the 108 cases of prostatitis studied, 31, or 28.7 per cent., showed gonococci in the prostatic secretion. The older the infection the less probable is the finding of gonococci in the prostate. After three years, gonococci are found rarely, even after most persistent efforts. Many and thorough examinations are needed before we can be at all certain that the gonococcus is absent from the prostate.

7. Mixed infection occurred in 86 per cent. of the cases studied. The gonococcus alone occurred in only 5 cases out of 108, and all 5 were cases of less than one year's duration. The older the case the more prevalent was the mixed infection. Staphylococci occurred in 7.4 per cent.; bacilli in 28 per cent.; Gram-positive diplococci in 10 per cent., and streptococci in 7.6 per cent. of cases with mixed infection.

9. The absolute need of microscopic examinations of prostatic secretion was shown by the fact that palpatory signs were absent in 38 cases (35 per cent.), while 13 cases (12 per cent.), showed absolutely clear urine, although the smears showed prostatic infection.

10. Gonorrheal prostatitis is curable by proper treatment in the great majority of cases.

11. Consent to marriage should not be given until all methods of examination have been exhausted and until the possibility of a post-marital infection is practically excluded, in the present state of our knowledge."

A similar research was made by Wolbarst<sup>1</sup> with much the same conclusions.

#### B. SYSTEMIC OR EXTRAUROGENITAL GROUP.

**Occurrence.**—In either acute or chronic gonococcal urethral infections constitutional complications may occur, perhaps the more frequently in the chronic lesions on account of the absorption and the exacerbations, which may duplicate acute attacks. All these extraurogenital involvements have been discussed under acute complications for the

<sup>1</sup> *Tr. Am. Urol. Assn.*, 1909, iii, 155.

reason that when they then occur they are so prominent. For this reason no further details will be given here.

**Varieties.**—Varieties in no wise differ from those given in the preceding chapter, but the most important to remember during chronic urethritis are the circulatory and the locomotory, especially as they affect the heart and the synovial membranes. The chief precursors of these two classes of cases are chronic seminal vesiculitis and chronic prostatitis.

The reader is, therefore, referred to Chapter III on Complications and Sequels of Acute Urethritis dealing solely with extragenital or systemic complications as they appear in each system of the body-organs.

CHAPTER VI.  
COMPLICATIONS AND SEQUELS OF CHRONIC  
URETHRITIS (CONTINUED).

**STRICTURE OF THE URETHRA.**

**Definition.**—"A stricture may be defined as an obstruction or closure, partial or absolute, of the lumen of any passage in the body. Thus, in familiar examples, the term stricture is applied to obstructions of the nose, throat, intestines and the urinary passages."<sup>1</sup>

**Varieties.**—Varieties include (1) as to cause congenital and acquired, inflammatory and traumatic; (2) as to site, anterior and posterior, intraurethral, extraurethral; (3) as to number, single and multiple; (4) as to limits, localized and extensive and even general; (5) as to form, linear, annular, diaphragmatic, valvular and bandlike; (6) as to behavior, elastic, irritable, inflammatory and lapsing; (7) as to density, callous or hard, and soft or contractile; (8) as to caliber, "open" being No. 20 French and larger, "close" being No. 20 to 9 French, both inclusive, and "tight," obstructing, or "filiform" strictures of 9 French and smaller.<sup>2</sup> It is to be noticed that an open stricture of full caliber is really an anatomical narrowing of the canal provided it is without symptoms of stricture as subsequently noted; (9) as to lumen, central and eccentric, direct and tortuous; (10) as to bacteriology, infective and suppurative, noninfectious and catarrhal; (11) as to pathological conditions, organic, fibrous and permanent, inorganic, spasmodic, temporary and complicated and uncomplicated.

**Etiology.**—In children strictures are either traumatic or inflammatory, of gonococcal or nongonococcal origin. Inasmuch as traumatism sufficiently severe for the production of stricture causes inflammation it may be said the even traumatic strictures are inflammatory. In adults and in children, therefore, etiology is more or less similar.

The predisposing systemic factors are the diathesis already discussed under etiology of acute and chronic urethritis on pages 28 and 29, producing a catarrhal tendency and continuous or relapsing condition. There are no exciting systemic causes.

The predisposing local causes are delicacy of the mucous membrane and its rather poor recuperative powers, tendency to deep-seated inflammation, exfoliation of the epithelium, exposure and involvement of the fibrous submucosa and extension into the periurethral tissue and finally the nature of the infection, particularly the gonococcal.

<sup>1</sup> Pedersen, V. C.: Jour. Am. Med. Assn., January 1, 1910, liv, 29-33.

<sup>2</sup> Pedersen, V. C.: Diagnosis of the Male Urethra, Arch. of Diag., October, 1910.



suppurative nongonococcal. The exciting local causes are either bacterial, as just stated, in frequent uncured and untreated, mistreated and overtreated attacks of any of the severe infections, notably gonococcal, or traumatism. The traumatism may be physical from falls, blows, rough and oversized instruments, chemical from concentrated irrigations, instillations and applications, thermic from hot liquids or instruments and electrical from the Oudin, d'Arsonval and other high-potential currents. Pressure from periurethral inflammation and neoplasm and obstruction of congestion, edema and intraurethral new growth may be direct exciting causes.

The writer had a case of traumatic stricture of the urethra from a chemical burn, followed by a complete cast of the canal about five inches long and later by complete fibrosis of the canal for this distance with the caliber of No. 23 French.<sup>1</sup> Fig. 75 shows this slough with a wire passed through it and dried in alcohol as preserving fluid.

A very clear statement of the etiology of stricture of the male urethra is given by G. Frank Lydston as follows:<sup>2</sup>

"1. Pressure from without, due to (a) neoplastic formation; (b) extravasations of blood or urine from injury; (c) purulent collections and infiltrations; (d) fracture of the pelvic bones.

2. Spasm of the muscles in and about the urethra, due to (a) direct irritation by lesions of the canal; (b) reflex irritation from more or less remote pathological conditions; (c) the introduction of instruments; (d) emotional excitement; (e) malaria (?); (f) highly acid and concentrated urine, and occasionally oxaluria and gravel.

3. Congestive or inflammatory engorgement of the urethra, due to (a) acute urethritis; (b) traumatism of the urethra; (c) inflammation in and about organic obstructions.

4. Thickening of the urethral walls, due to (a) congestive and granular patches in the mucous membrane, *i. e.*, superficial infiltration from chronic inflammation; (b) plastic infiltration and formation of connective tissue in the meshes of the corpus spongiosum from severe and long-continued inflammation; (c) cicatricial deposit in the corpus spongiosum and urethral walls incidental to traumatism; (d) cicatricial deposit incidental to the action of various caustics and powerful irritants; (e) cicatricial deposit incidental to ulcerations or sloughing from impaction of foreign bodies.

5. Deficient elasticity of the urethral walls and corpus spongiosum—(a) from congenital sparsity of elastic and muscular fiber and a preponderance of fibroconnective tissue; (b) from inflammation.

6. Congenital narrowing or slight atresia of the urethra from defective fetal development.

7. Polypi of the urethral mucous membrane."

From a clinical standpoint strictures may be divided as regards their origin into (1) congenital; (2) acquired; (a) traumatic; (b) chemical;

<sup>1</sup> Pedersen, V. C.: New York Med. Jour., May 25, 1912.

<sup>2</sup> An American Text-book of Genito-urinary Diseases, Syphilis and Diseases of the Skin, Bang-Hardaway, 1899, p. 133.

(c) acute inflammatory or congestive; (d) chronic inflammatory; (e) neurotic.

As regards the essential condition producing the obstruction they may be divided into—(1) spasmodic; (2) congestive or inflammatory (circumscribed or general); (3) organic or fibrous (permanent), *i. e.*, neoplastic."

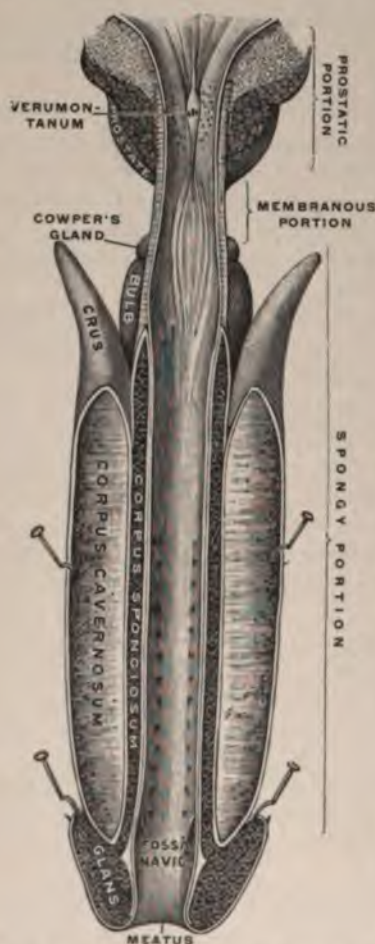


FIG. 88.—The male urethra laid open on its anterior surface. (Gray.<sup>1</sup>)



FIG. 89.—Thread-like stricture involving only a portion of the circumference of the urethra. (Taylor.<sup>2</sup>)

**Pathology of Stricture.**—Many features of the pathology of stricture have been described under pathology of chronic urethritis on page 265, and will therefore need only allusion. In children and adults the underlying conditions are much the same, and at their final basis chronic productive inflammation. Stricture in the female, so far as closure of

<sup>1</sup> Gray's Anatomy, 20th ed., 1918.

<sup>2</sup> Genito-Urinary and Venereal Diseases, 1904.

al is concerned, is almost unknown, because the canal represents anterior urethra of the male, which is the most dilatable portion

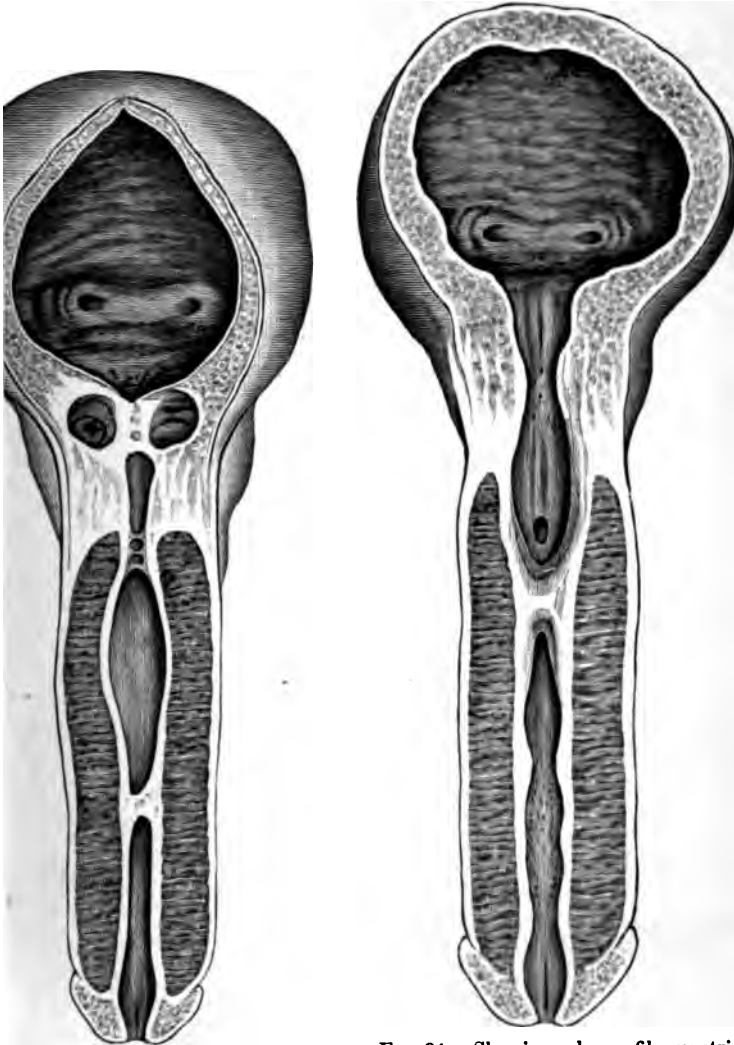


FIG. 90.—Showing firm fibrous stricture in middle of the pendulous urethra, dilatation of the canal behind it, nodular hypertrophy of the bulb, abscess of the prostate, hypertrophy of the bladder and dilation of orifices of the ureters. (Taylor.)

FIG. 91.—Showing a dense, fibrous stricture of the urethra just beyond the penoscrotal angle, with dilatation of the bulbous, membranous and prostatic urethra. The pendulous urethra is also much thickened and infiltrated. The walls of the bladder are much hypertrophied, and the orifices of the ureters dilated. (Taylor.)

ever closed by ordinary endourethral conditions, although the inflammatory infiltration and all other features of stricture may be treated.

The pathological varieties are two: congenital and acquired.

**Congenital Stricture.**—Congenital strictures are summed up as atresia or malformation of embryologic origin, to which subject they strictly belong.

**Acquired Stricture.**—Acquired strictures are either inflammatory or traumatic and practically the same because inflammation is produced by severe injury. The pathology of acquired stricture includes that of the causal conditions already named, which must be omitted as foreign to this book. The pathogenic relation, however, must be mentioned and remembered between stricture and such conditions as periurethral neoplasm, extravasation, abscess and fracture and endourethral polypi.

**Organic Stricture.**—The pathology includes that of all other forms in one or more of their details. The essence is a cicatrix resulting from chronic productive inflammation and followed by secondary contraction, retraction, deformation and obstruction all in varying degree and extent from moderate to tight closure and from small to large portions of the canal. The location is in the mucosa, submucosa, corpus spongiosum and even periurethral tissues, with a distribution at one point or many points, with about 60 per cent. of all forms between the bulb and the penoscrotal angle. The tissues involved are the mucosa in its epithelium, glands and vessels, the submucosa, the corpus spongiosum and periurethral structures in their fibrous basis. The mucosa in its epithelium is exfoliated or denuded into an ulcer which does not heal without involvement of the deeper structures. About this, desquamation may be active and constant, accounting for the abundance of epithelial cells in the discharge of stricture cases. The glands and follicles are overactive, hyperemic and hypertrophied with abundant thick discharge or atrophied by loss of lining or by pressure of connective tissue deposits. Surrounding glands take up compensatory function in order to maintain the moisture and thus slugs of mucus and shreds are often produced. The bloodvessels are hyperemic in acute and multiplied in chronic phases, causing again changes in the epithelium, glands and fibrous tissue. Diapedesis of leukocytes is common during acute periods. Discharge associated with stricture is therefore the rule and comprised of pus and mucus, fluid or coagulated into shreds, white blood cells in various degrees of degeneration and occasionally red cells.

The submucosa is thus laid bare in superficial or deep ulcer, accompanied by small cell infiltration, spindle cell new fibrous tissue and followed by dryness, retraction, contraction, deformation, narrowing and obstruction. The first three of these processes are inherent in new fibrous tissue anywhere in the body and the last three are its essential sequels in any canal of the body.

The corpus spongiosum and periurethral tissues are invaded in exactly the same manner by strictures of marked degree without or with complications, so that much of the substance of the corpus may be replaced by dense cicatrix.



FIG. 92.—Complications of stricture. Strictures are shown in the penile and bulbous urethra with thickening of the mucosa, enlargement of the mucous crypts and behind the strictures, dilatation and profound changes in the walls of the canal. The bladder walls are densely hypertrophied to many times the normal thickness and trabeculations are distinct. (Taylor.)

<sup>1</sup> Loc. cit.

The temporary lesions are hyperemia, catarrh and mild suppuration about and upon the stricture substance. These may light up under provocation of even mild degree to an edema which will close the canal acutely, resulting in the edematous or so-called "inflammatory" stricture. On the other hand, these temporary lesions may ultimately be fully cured.

The permanent lesions are the cicatrix itself and the profound changes which its obstruction and associated infection may produce proximal to it in the urethra and its adjacent glands and even in the urinary system from the bladder to the kidneys. Such outcomes may be either complications or sequels of the stricture or associated conditions marking the severe process which causes the stricture.

The complicating and associated lesions, occurring rarely in congenital but more commonly in acquired stricture, are in fact ascent of the hydraulic back-pressure of the stricture and its infection either by continuity of the mucosa which lines these organs and channels as a whole system or through the bloodstream by metastasis. There, therefore, occur in highly diverse relations and degrees urethritis, prostatitis, hypertrophy, dilatation, atony and inflammation of the bladder, ureteritis, pyelonephritis and septic absorption.

The urethritis may be rather benign, as overactivity of the glands to compensate for those destroyed, or severe, with proximal to the stricture, dilatation, hypertrophy and atony of the membrane and its muscles, chronic glandular infection, overactivity and atrophy. Ulcer, concretion and abscess are not rarities and even fistulae with perineal, scrotal, gluteal, femoral and abdominal outlets. The prostatitis may be of the follicular type with exfoliation of the lining epithelium or more profound, of the glandular or parenchymatous form with single or multiple relapsing or chronic abscesses. In the bladder the wall is hypertrophied by resistance, then dilated by distension and finally atrophied. Retention, decomposition and infection of the urine next follow, chiefly by the *Bacillus coli communis*. On the other hand, the gonococcal infection with its pyogenic allies may extend from the urethritis directly into the bladder. The ureters become involved by parallel processes when the back-pressure overcomes the bladder wall and causes them to dilate and transfer the hydraulics of the whole condition and the infection to the pelvis and even substance of the kidney. Thus the entire urinary system from the point of stricture to the kidney may show any or all the foregoing lesions in a highly complex picture, which needs no further details.

*Inflammatory Stricture.*—The pathology is usually temporary in the form of congestion and edema as separate processes or added to an organic fibrous stricture or as the introductory stage of the latter, thus producing acute obstruction. The term inflammatory stricture is misleading through confusion with the inflammation underlying all stricture, so that perhaps the term edematous stricture would be more accurate. As just indicated, this edema may occlude the urethra but may subside and lead to no other process or it may appear on the



surface or annexa of an organic stricture whose small lumen may thereby be made impassable. Thus an organic stricture may have edema as a temporary and relapsing element appearing under the least exciting factor.

Edematous or so-called inflammatory stricture may be engrafted on any of the other forms or through faulty instrumentation be of itself a clinical entity. Its lesions are much like those of organic stricture except that it arises quickly to its full degree of closure and has relatively few signs of inflammation such as discharge. It is never a chronic condition or chronic obstruction in the exact meaning of these terms.

*Spasmodic stricture* does not possess a true pathology, in that it arises from muscular response to psychic inhibition during fear or emotion, to spinal inhibition during various organic disease of the cord and finally to local irritation through offense of instruments, instillations, applications, gravel, hyperacidity and hyperalkalinity of the urine and toxemias, as of malarial origin.

*Stricture by external pressure* shows the pathology of the pressure, chiefly in circulatory congestion, edema and the like, added to and subsequent to the pathology of the causative factors, as enumerated in the paragraphs on etiology on page 350. Lack of space forbids minute discussion of the pathology of the causative factors.

*Traumatic Stricture.*—Commonly in traumatic stricture, especially those due to chemical and thermal sources, the infiltrating inflammation is in the entire circumference of the canal and along a considerable extent. It is for this reason that this type of stricture is most profound in its pathology, far-reaching in its results, intractable to treatment and prone to relapse, because the mucosa as a whole instead of being deeply damaged in one or more separate parts and a small extent and little depth of the canal, is obliterated and replaced by dense scar.

The forms of acquired stricture are annular, diaphragmatic, valvular and bandlike. The annular or ring-form type are chiefly meatal, with centric opening very small or only slightly reduced, and may be the sign of true atresia. The diaphragmatic obstruction is a little like the hymen in woman, and comprised of a fold of mucosa at the meatus, lacuna magna or bulb, affords partial definite obstruction and has centric or eccentric lumen. Valvular narrowing consists of transverse folds at almost any point of the urethra, but chiefly the prostatic urethra and at the penoscrotal angle. Bands may have almost any form and situation, with little clinical influence.

*Chronology of Stricture.*—This varies with the form. Edematous, or so-called "inflammatory" stricture, may arise quickly in the midst of almost any acute urethral lesion and may itself be added as an acute process in the surface or annexa of organic stricture. These facts are responsible for the misapprehension among the laity and profession alike that stricture is a rapid process and often lead to premature and injudicious treatment of such an infiltration and thereby it is converted from a temporary to a permanent condition. Organic stricture of infectious origin is ordinarily a very slow process, exactly like all other



scar tissue. If the infection actively continues along with the chronic productive inflammation in the stricture then the latter may be relatively rapid, appearing in a few months instead of years. This is often the outcome of the irritation, with instruments of edematous stricture by continuance of the inflammation and addition to the scar tissue. Total obstruction in organic stricture is almost always slow unless the element of edema is at any time added, as just noted. Organic stricture of traumatic origin, on the other hand, may be not only rapid, but also concomitant with the healing of the injury, which may leave a scar or infolding of the mucosa and obstruction in high degree. The progress of stricture due to neoplasms and similar conditions rests, of course, on the nature of such antecedent element.

The pathology of *extravasation of urine and blood* as a complication of stricture is dealt with under this heading as of sufficient importance for a special section of this chapter on page 421.

*Caliber of the Urethra.*—The normal anatomical narrowings are most important and should never be forgotten. Numerous measurements have been taken with urethrometers, bulb-sounds and casts after death with the following table given by Taylor<sup>1</sup> as an accepted average of results:

Length.	Diameter.
Meatus, 7 to 9 mm. . . . .	21 to 28 F.
Fossa navicularis, 10 to 11 mm. . . . .	30 to 33 F.
Middle of pendulous portion, 9 to 10 mm. . . . .	27 to 30 F.
Bulb, 11 to 12 mm. . . . .	33 to 36 F.
Membranous urethra, 9 mm. . . . .	27 F.
At apex of prostate, 10 mm. . . . .	30 F.
Middle of prostate, 15 mm. . . . .	45 F.
Vesical end of prostate, 11 mm. . . . .	33 F.

The most significant feature of this list is that where the urethra passes through the triangular ligament, as the most fixed tissue in its course, its average diameter is No. 27 French. It is consequently a safe rule to follow never at first to pass an instrument larger than No. 26 or 27 French until the resistance offered by this ligament is known. The extremes of variation in the meatus from No. 21 to 28 French often likewise determine the size of instrument acceptable. A most significant fact is that practically all subjects may be cystoscoped and urethroscoped, with the standard instrument, which in almost all designs is No. 24 French and in very few models No. 26 French. Behind the meatus comes the fossa navicularis, which is one of the wide portions of the canal and may by its reduction at its proximal limit deceive the unwary into the diagnosis of stricture at that point. The bulb of the urethra is another very wide portion, and in the urethroscope may simulate many of the folds and features of the bladder in miniature. It may be so deep a pocket as to catch the tip of the sound in its proximal portion. The prostatic urethra in the male, like the whole canal in the female, is the widest and most dilatable portion. Thus it will be seen that

<sup>1</sup> Genito-urinary and Venereal Diseases, 3d ed., p. 173.

broadly there are four dilatations: that is, in the fossa, bulb, membranous urethra and prostate, at each extremity of which there are more or less distinct narrowings. These normal anatomical narrowings, however, differ from stricture in always being elastic, readily passable, promptly resuming their former caliber and free of the usual subjective and objective symptoms of stricture and its associated catarrh or suppuration of the mucosa.

In addition to these normal narrowings the mucous membrane is in many subjects thrown into numerous transverse folds not unlike similar folds in the bowel, notably the rectum. They may be sufficiently well developed to engage an instrument and thus simulate stricture, so far as a slight change in the lumen of the canal is concerned, but the absence of symptoms of stricture establishes their characteristics.

From the foregoing anatomical arrangement it will readily be judged why strictures are so apt to form at more or less common portions of the canal. It is fully accepted that the reason why the canal from the penoscrotal angle to the triangular ligament is so often invaded by stricture is that the pouch of the bulb more or less persistently pockets the pus and the normal folding or constriction of the urethra at the angle retards its drainage. Similarly if the meatus is small or if the mistake of wearing cotton over it is employed, the pus will be retained, penetration of the inflammation invited and stricture ensue.

Although the general pathological features of all forms of stricture are more or less similar and although the same observation may be properly applied to the symptom complex, it is nevertheless better to consider the clinical features of each important variety as an individual entity.

**Symptoms of Stricture.—Organic Stricture.**—The clinical picture of stricture provides subjective and objective systemic and local conditions. In the average case, without serious complications and absorption of septic products, there are, strictly speaking, no systemic symptoms but the complicated cases in which the proximal urethra, the prostate, seminal vesicles, bladder, ureters and kidneys may be involved, may present many or any of the local or general symptoms present in profound suppurative disease of these organs as stated under each. In children stricture is a little more apt to be congenital or traumatic and in adults inflammatory through chronic suppuration. The local subjective symptoms may be classified (1) as those arising from the urethra, urinary and sexual organs; (2) as proceeding from the antecedent inflammation; (3) those due to the obstruction slowly or rapidly established; and finally (4) those inherent in the complications of stricture.

The urinary symptoms comprise the first three items of this list and add all those which proceed from the complications and sequels of stricture in the bladder, ureters and kidneys. The first group is therefore described with the urethral symptoms as follow, and the second group will be dealt with under complications on page 418.

The urethral symptoms are discharge, pain, frequency of urination, obstruction and altered stream.

The discharge has its origin in the urethral glands, granulation tissue about the stricture and the urethra and prostate proximal to it. It usually appears as a drop in the morning in mild cases or several times during the day in more marked cases and is, therefore, of very moderate quantity, as a rule, in uncomplicated cases but copious in complicated cases. Its color is white or yellow in accordance with the presence of pus mixed with the mucus and its constituents are chiefly mucus, pus and many epithelial cells, as described on page 270, exfoliating from the surface and annexa of the stricture.

The pain is due to the open lesions usually proximal to the stricture, and also due to the urethritis and urethrocystitis accompanying it and to the stretching of the mucosa by the back-pressure during urination. It, therefore, occurs during this act and is usually greatest in cases with the most active sign of inflammation and often in cases involving the bulb, probably because the urine tends to stagnate in the bulb and cause inflammation there and in the proximal portions of the canal. In degree it varies from mere uneasiness to positive ardor which may persist for some time after urination, especially in the victims of dribbling, as described later.

The frequency and tenesmus of urination are based on the irritation of the urethritis in and about stricture and of the urethrocystitis. In uncomplicated cases the granulation tissue around the stricture if in the anterior urethra may cause a diurnal frequency of once in a few hours in average cases only slightly above the normal, or once in a fraction of an hour in marked cases, especially if the posterior urethra and neck of the bladder are included. In complicated cases the prostatitis, cystitis and other higher urinary involvement may cause nocturnal as well as diurnal frequency of aggravating degree. Naturally tenesmus is found only in the latter type as it rests on involvement of the sphincter muscle and floor of the bladder.

The foregoing clinical picture is classified as early symptoms in that they are present often before obstruction is great, but they may also mark the transitional period and increase with the degree of closure of the stricture.

The sense of obstruction is shown by the added effort at emptying the bladder, and may be at first and for years moderate, and hardly attract the patient's attention. It may slowly progress up to a certain point and thereafter rapidly by complications and sequels until a high degree of closure is reached. The so-called tight strictures which permit only a filiform to be passed are extreme in this symptom and require a muscular effort which may expel flatus from the rectum and may induce or increase hernia.

The alteration and dribbling of the urine as associates of the obstruction may appear late or early among the subjective signs. A meatus large normally or postoperatively, will flatten, weaken and spread the stream much as the flaccid urethra does in woman, whereas a meatu:

small normally, or by stricture, compresses the stream and adds to its projection. The natural narrowing of the urethra at its outlet is probably for the purpose of projecting the outflow away from the body. The stream of stricture is altered in initiation, form, maintenance, force and termination. The beginning of the act may be difficult from the resistance or reflex irritation proximal to the narrowing. Continuation of the stream may through failure of the bladder force or otherwise be interrupted so that the stream begins, stops and then resumes. The form is single, twisted and spattering, or doubled, forked and broken. The force may be little changed or decreased until the urine reaches the meatus and falls vertically from it. The termination instead of prompt dryness of the parts may be prolonged into drops or moisture for several moments and be followed by a drop of mucus and pus. Such terminal dripping is due to the obstruction and the pocket behind it combined with the rigid, inelastic inflamed walls of the urethra and weakness of its muscle coats.

The urinary symptoms, not already described as dependent directly on the urethra, are chiefly referred to the bladder, ureters and kidneys, practically always as complications and sequels of stricture, although the same severe process which evolves the stricture may also involve these organs. Such symptoms may, therefore, be dismissed as the same as those already noticed under urethrocystitis, cystitis, ureteritis, and pyelonephritis in the subject of Complications of Gonococcal Urethritis on pages 163 to 188 and again in Chapters XIII, XIV, XV and XVI.

The sexual symptoms have the basis of irritation, obstruction and the complications. The irritation about a stricture, especially one near the posterior urethra, induces increased desire, which is followed either by frequent nocturnal emissions, excessive normal intercourse or perversions. The discharge of semen over the granulating inflamed urethra causes ardor and the muscular action of ejaculation and distention behind a tight stricture causes pain exactly as does urination. In marked obstruction retrograde ejaculation has been often reported in which the semen is discharged into the bladder, and still more commonly are seen patients who do not ejaculate externally at all in the true sense, but whose semen is later washed away with the urine after subsidence of the turgescence of erection and intercourse. Also after repose followed by urination the stricture again opens slightly. It is the congestion of the inflammation and the stimulation of irritating elements associated with stricture, which both locally and in the spinal cord produce increased desire and frequent erections without or with the presence of women. Therefore, men with stricture working in the midst of women are not infrequently literally tortured and the sexual excitement alone or the mental impression made by the emissions, or the actual presence of the opposite sex or all three combined frequently lead to inordinate practices. As a rule, emissions being reflex are less harmful than intercourse or perversions which are intentional. The turgescence, however, of all these processes adds to the congestion and inflammation around the stricture and its other symptoms so that

all the conditions of stricture dependent on inflammation are apt to be increased.

Another sexual symptom is chordée and even incurvation in inflamed irritable strictures with much urethritis above and below them. As previously noted, this is a symptom of urethritis in its earlier stages so that when it is found in stricture cases it is to be accepted as the index of the urethritis rather than of the fibrosis itself. It reaches extreme development in incurvation, which is usually not seen unless a large portion of the canal has been changed into scar tissue and thus has lost extensibility and distensibility, and thus compels the corpora cavernosa to incurvate rather than distend into a perfect erection, to the great disquietude of the patient.

The sexual complications reside in the seminal vesiculitis, relapsing epididymo-orchitis and prostatitis and do not differ from those laid down for these conditions during acute and chronic urethritis on pages 83 and 313.

The local objective symptoms are in many respects the same as the subjective type in nature and origin, and comprise chiefly discharge, obstruction, altered stream and complications. The discharge requires laboratory examination and will be found to comprise mucus, pus and epithelium each chiefly predominant or all variously mixed according to the activity and suppuration of the process. The gonococci should always be searched for by smear and culture and its influence on the system at large determined by the complement fixation test. Competent bacteriologic investigation will also reveal the nature of other organisms, such as catarrhal and pyogenic, and should be carried out whether the discharge is free or not, or consisting only of shreds in the urine, collected under full antiseptic precautions.

The obstruction is revealed by the altered stream and by external and internal palpation. Changes in the stream of urine observed corroborate the patient's description, but the projection of the stream is the most important element for notice as it indicates the patency of the stricture and the condition of the urethra and bladder proximal to it. Visible effort during the ejaculation and flatus are significant. External examination of the urethra reveals in mild cases one or more moderate thickenings and in severe cases large nodes or collars with dilatation and hypertrophy or atony of the urethra behind them. Such palpation may also bring to the front discharge in larger than usual amount through expression of the mucous follicles. Patients may themselves show the sites of strictures but sometimes do so anteriorly to the real points because of reference by the nervous system of the symptoms toward the glans penis.

The internal examination of the urethra is carried out with sounds, catheters, bulbous bougies, whalebone filiforms and the urethroscope, and varies with the tightness of the stricture; in other words, with the severity of the case. In open strictures, size 20 French and larger, a round-point sound with no taper is a very valuable instrument for demonstrating the situation and character of the narrowing. In this

icular the Béniqué curve instrument is extremely advisable as it is to accommodate itself to alterations in the proximal urethra with little inconvenience to the patient. The Bangs syringe sound may be employed for such service and likewise as part of the exploratory for treatment of the stricture and its annexa with mild solutions. The round points of these instruments are relatively difficult to insert but, as a rule, one several sizes smaller than the tapered instruments is available, but through that very fact it will often locate an opening where the tapering bulbous bougie will fail to discover. With the sound or the Bangs syringe in place, careful external examination of the urethra should be made proximal to it or over it to determine the character of the infiltration. Catheters, especially lisle-thread and silk gum-elastic catheters may be employed in much the same manner, especially if the history is one of irritability about the stricture, in which will be much less disturbed by flexible than by rigid instruments. For the same service the various conical and olive-pointed bougies and catheters lend themselves but somewhat more successfully to the closed mass of stricture.

In close stricture, that is, from 10 to 19 French, inclusive, the bulbous bougie is the instrument of choice and may either be of metal or gum elastic. The latter is to be preferred in every way because this degree of narrowing is much more apt to be associated with more or less chronic inflammation, if not infection, whose lesions should be invaded with great gentleness. They are made, as a rule, double ended, one olivary and the other conical, of which the former is the better to use, again for the reasons that it does not dilate so readily and may impinge on the anterior surface of the stricture which the cone would otherwise pass. Careful palpation of the urethra proximal to a bougie which has not passed the stricture and distal to one which has slipped through, should always be carried out. If the head of the instrument is through the stricture it should be drawn back until it engages in order to facilitate such study. The advantage of bulbous bougies over sounds for all stricture examination is that they will more readily pick out the number of strictures, whereas a sound will locate only the closest and may slide through without observation others that may be slightly more open.

In tight strictures the whalebone filiform guide is the only instrument available and, like the sound, will locate only the tightest point through which it may or may not glide. On account of the inflammation and granulation tissue practically always around a tight stricture, it is very good policy to flush the urethra with water or normal salt solution, hot up to tolerance, in order to reduce the edema. The urethra may also be filled with adrenalin solution for five or ten minutes with the same purpose. A hot sitting bath in patients who have suddenly had an edematous or inflammatory stricture engrafted on the right lesion through debauchery, instrumentation or other accident, is of great value in passing the lesion. After these preliminaries filiforms of 3, 4 and 5 French diameter, with their tips left

straight or variously kinked, are passed into the urethra one after the other until the canal is full, with movement of the filiforms still possible. After every two or three have thus been inserted, each of the whole number is again gently manipulated in the effort to engage it in the narrow and usually tortuous canal. There are very few strictures indeed which by this method with greatest gentleness and patience through many minutes or even an hour are impassable. It is safe to say that a stricture which is pervious to urine is also pervious to a filiform, after suitable preparation of the urethra and the patient, if in the hands of an expert. Roughness in any degree is to be forbidden, as it instantly adds a stricture by edema to the condition already existing.

The value of sounds, catheters, bougies-à-boule and filiform guides in the treatment of stricture is described on pages 377 to 384.

The urethroscope is of value in the internal examination of stricture of open, close and tight varieties. Instruments of the Buerger type with a lateral window are available in studying the urethra distal to the stricture which is impassable to itself and the urethra proximal to it in the reverse situation. Instruments of the Otis type with terminal opening and either extrinsic or intrinsic illumination are of special value in seeing the anterior surface of close or tight strictures which the window of a Buerger instrument will not reach on account of the long tip which accommodates the lamp. Another service of this form of urethroscope is an aid in the introduction of filiform guides. Occasionally the lumen of a stricture may be located with the urethroscope, decongesting applications made directly to its surface and a filiform passed through it under the eye when previous efforts have failed. Availability of the urethroscope for the treatment of stricture is dealt with on page 393.

The objective sexual symptoms frequently have no definite basis; on the other hand, the conditions underlying them already described under subjective phenomena may be proved by careful examination especially with the urethroscope. For this reason every victim of pronounced sexual activity through his stricture should receive a careful examination with this instrument. Likewise the relation of complications with this variety of symptoms must not be omitted.

The objective complications duplicate those given under this subjective heading and will need no further details than those portrayed in Chapters II and V for the same conditions arising from urethritis in acute or chronic form.

Rectal examination in stricture, with and without instruments in the urethra, should never be omitted except in the simple uncomplicated cases, and in these it is good judgment to employ it as the final step of diagnosis. Frequently in no other way may the condition of the urethra immediately about the triangular ligament, the bulb in front of it and the prostate behind it be fully made out. Previously unsuspected complications reveal themselves to this step and the density, irritability and discharge of the stricture are readily developed.



The subjective facts are those of sudden incidence of one or more of the following factors on an antecedent basis. The patient is suddenly unable to pass water sometimes within a very brief period of time or a few hours after instrumentation. The objective features are edema of the urethra which commonly supervenes upon the application of a hot bath, hot urethral irrigation and the gentle instillation of chlorid as decongestants. The suggested diagnosis of edema of the urethra requires urethral investigation until its subsidence and then with care to determine its cause. In the absence of any other cause of retention of urine it is advised in order to find the cause of the outbreak.

**Idiopathic Stricture.**—As in other forms of stricture, we may distinguish between subjective and objective signs. There is the history of sudden repeated previous attacks with few symptoms and, as a rule, no urinary closure, as the spinal cord compels the spasm to discontinue soon as the bladder is greatly filled. On the other hand, there is a history of the sphincter muscle dependent on organic disease of the spinal cord which does not so relax and may lead to overdistention and retention of the bladder unless relieved by passing a catheter or suprapubic puncture. Some patients have spinal spasmodic closure of the urethra and cannot defecate at the same time and all present more or less the picture of profound mental impression rather than definite disease. The writer recalls one of his patients, a young neurologist, who had a long well-marked history of masturbation, who presented with a distended bladder and rectum which he had not been able to empty for eighteen or twenty hours. One similar attack of urinary retention had preceded it. Physical examination was negative except for the distended bladder and a prostate edematous by pressure on the bladder, as there was no element in his story to correspond with congestion, inflammation or relaxation. A soft gum-elastic catheter was passed and the urine passed.

at this point that the spasm begins to manifest itself with involvement of the sphincter vesicæ finally. A consultation case of the writer presented a man whose physician after a successful relief of a gonococcal acute urethritis had been unable to pass a sound after several normal attempts. The feat was easily accomplished after noting that the tip of the instrument seemed to present in the perineum where support with the finger upon the external surface lifted the sound into the membranous and prostatic urethra where it encountered spasm at the neck which easily yielded to pressure by the weight of the sound itself within about ten minutes.

The objective symptoms are, therefore, the nervous behavior of the patient, the fact or history of a good stream on other occasions, absence of inflammation in the urethra, and during the examination rigidity of the abdominal and anal muscles. A point of obvious irritability as the sound progresses or encountered with the bougie-à-boule is very important and study of it by the urethroscope should at once follow.

**Stricture by Periurethral Pressure.**—As already indicated, stricture by extraurethra pressure may arise from new growth, extravasation, abscess and fracture of the bones of the pelvis, whose action is essentially obvious in direct focal compression of the canal. According to the cause the closure has relatively slow subjective symptoms in new growth and in abscess unless occasionally in the former and more frequently in the latter the element of edema is added, when rapid onset may ensue. Extravasation of blood and fracture produce at times sudden closure directly or by early secondary edema and are, therefore, the sources of acute stricture in these classes of cases. The objective local symptoms afford the signs in the perineum and rectum of neoplasm or abscess of the prostate and of the accumulation of blood and urine and the displaced bone. The value of the x-ray in the latter is apparent. The slower forms of stricture of this type may be explored by bougies-à-boule, catheters and dilators and whalebone filiform guides—all flexible by choice, and used with great deliberation. Steel sounds, silver catheters, cystoscopes and urethroscopes are to be used with reserve. The open-end urethroscope may be passed down to the face of the obstruction for study. The obvious appearance of edema as the source of stricture supervening on the foregoing factors may be proved by the steps hereinafter stated, namely, of suitable external and internal applications of heat and mild astringents.

**Traumatic Stricture.**—The results of accident are chiefly urethral and urinary and may develop the subjective and objective local signs immediately after the injury in virtue of the trauma itself or of the imperfect manner of healing of the canal or both combined. On the other hand, it may be a later development after the tear has closed and arise from the urethritis which the deformity of the canal excites. Such a traumatic stricture becomes indubitably inflammatory, under which heading all strictures by injury may be classed because injury excites inflammation. Traumatic strictures are for the most part tight or filiform, that is, 9 French and smaller and therefore have a

**Inflammatory or Edematous Stricture.**—As previously noted under pathology, stricture by edema is usually a factor added to one of the other forms, either in the course of the inflammation itself or in virtue of irritation by instruments, applications or debauch. In a certain sense it is, therefore, both inflammatory and traumatic. In the latter case it may sometimes be seen in a relatively normal urethra which has been explored, treated or urethroscoped with undue violence or frequency and it is a very common temporary outcome of dilatation treatment of stricture carried on in steps too large and frequent. The subjective facts are those of sudden incidence of one of the foregoing factors on an antecedent basis. The patient is suddenly unable to pass water sometimes within a very brief period of time or during a few hours after instrumentation. The objective features are that urination commonly supervenes upon the application of a hot sitting bath, hot urethral irrigation and the gentle instillation of adrenalin chlorid as decongestants. The suggested diagnosis of edema precludes urethral investigation until its subsidence and then with great gentleness it is advised in order to find the cause of the outbreak.

**Spasmodic Stricture.**—As in other forms of stricture, we may distinguish subjective and objective signs. There is the history of sudden and even repeated previous attacks with few symptoms and, as a rule, only temporary closure, as the spinal cord compels the spasm to disappear as soon as the bladder is greatly filled. On the other hand, there is spasm of the sphincter muscle dependent on organic disease of the spinal cord which does not so relax and may lead to overdistention and atony of the bladder unless relieved by passing a catheter or suprapubic acupuncture. Some patients have spinal spasmodic closure of the rectum and cannot defecate at the same time and all present more or less the picture of profound mental impression rather than definite urethral disease. The writer recalls one of his patients, a young neuropathic Hebrew with a long well-marked history of masturbation, who appeared with a distended bladder and rectum which he had not been able to empty for eighteen or twenty hours. One similar attack of shorter duration had preceded it. Physical examination was negative except for the distended bladder and a prostate edematous by pressure of the bladder, as there was no element in his story to correspond with prostatic congestion, inflammation or relaxation. A soft gum-elastic catheter of moderate size was passed with great deliberation and gentleness and soon overcame the spasm.

A larger series of cases of spasmodic stricture occur during urethral manipulation in virtue of such features as the stretching of an abnormally close meatus or the passing over granulation tissue or the engaging of an instrument in the depth of the bulb of the urethra instead of passing through the membranous urethra unimpeded. The patient usually presents a nervous expression of face, rigidity of the abdominal muscles and even of the sphincter ani through which the finger passes with difficulty for exploration of the bulb and guidance of the tip of the instrument through the membranous urethra. It is commonly

explored with bougies-à-boule, sounds and the urethroscope for any tendency toward recontraction, which should be dealt with according to indication. The interval of passing instruments in prevention of relapse is a matter of study and experience in each case and of behavior toward the stricture. Observation of shreds and other signs of urethritis and about the site of the former stricture is a most important detail in foretelling the outlook of the case.

**Diagnosis.**<sup>1</sup>—The recognition of stricture depends on the four factors of history, physical examination, laboratory analysis and treatment. The last concerns more the matter of relapse. In the history we have the causal factors of trauma, operation, long repeated and relapsing urethritis and pressure by the prostate and neoplasm, and occasionally the detail of nervous irritability in spasmodic examples. The diagnosis of diatheses is important on account of their relation with urethritis, associated with stricture. The subjective symptomatology belongs to the history and reveals discharge, pain, frequency, tenesmus, sense of obstruction, altered stream and urine, sexual disorder and sexual or urinary complications. The physical examination should include the general constitution of the patient, as just stated, and the external and internal urethral examination, embracing also rectal touch. External palpation usually reveals but little, but examination within the urethra with bougies, sounds, urethroscopes, filiform guides, catheters and the like is of preëminent importance and should never be omitted. A preliminary meatotomy is often necessary for suitable diagnosis and treatment as through the urethra stenosed by a small meatus very little can be accomplished. The points to be recognized are the diameter of the stricture, the distance from the meatus, extent, number, condition of the proximal mucosa, congestion, irritability and resiliency of the band. Many stricture cases suffer from toxemia and absorption, so that slight instrumentation induces urethral chill. This may often be aborted by the administration of a pill containing morphine, grains  $\frac{1}{2}$  to  $\frac{1}{4}$ , fluidextract of aconite, minims 1 to 2, and quinine, grains 5. Usually one of these pills in dose, according to the patient's constitution, given in the forepart of the examination, will abort the chill. Irrigation of the urethra with mild antiseptics and the administration of urinary antiseptics internally are other cautions. Patients should be warned as to the ardor urinæ which follows exploration and aided by the administration of alkalies, blennorrhetics and urinary antiseptics.

The bacteriology and infectiousness of a stricture are synonymous and are very important because instrumental invasion of the region may be followed by direct transference of organisms into the urinary organs. Such accident is, however, commonly avoided by the foregoing precautions. A more serious condition which cannot be so readily avoided is direct absorption of the gonococci and other organisms into the blood current through minute wounds of the mucosa essential and avoidable during the exploration. The writer recalls a case in which

<sup>1</sup> Pedersen, V. C.: Arch. Diag., October, 1910.

polyarthritis of both knees, one shoulder, both elbows and  
as well as probably a myositis, followed the sounding of a



FIG. 93.—Exploration of a stricture with a sound. The left hand gently holds the sound against the stricture, while the right hand upon the perineum or in the scrotum locates and studies the stricture. (Original.)



FIG. 94.—Exploration of a stricture with the bougie-à-boule. The left hand holds the bougie against the face of the stricture and holds the urethra gently open. The right hand locates the instrument and examines the stricture beyond it.

thin a few hours, in which no bacteriologic knowledge of the case had previously been secured. The details of such bacteriologic investigation need not be repeated more than to say that they include smears and culture of shreds, centrifuging the urine and again making smears and cultures and finally the complement fixation test of Schwartz. Such an investigation puts us at once in control of this important part of the case.



FIG. 95.—Palpation for stricture with the bougie-à-boule. The penis is supported in the left hand in the vertical position and the instrument is gently passed along the canal until the obstruction is felt. The index finger and thumb of the right hand now raise it at the meatus for withdrawal and for marking the distance of the node from the outlet. (Original.)

The diameter of the stricture is measured by passing flexible bougies-à-boules, beginning with the largest which will pass the meatus, thus reaching the anterior limits of the infiltration and perhaps showing strictures of larger caliber in front of it previously unsuspected. The same instrument may be used to measure the distance from the meatus of each such stricture. Finally, a bougie-à-boule is secured which passes through the narrowing and then, as it is withdrawn, its point of engagement on the posterior surface of the narrowing is noted and measured and the difference between this measurement and that of

the face of the lesion from the meatus indicates the extent of the stricture along the canal. If no bougie-à-boule will pass the stricture, then the whalebone filiform guide becomes available and the extent must rest on external and rectal palpation of the urethra. By these steps not only are the number of stenoses developed, but with gentleness the condition of the mucosa about them may be suggested. The urethritis almost universal above a stricture is easily provoked into bleeding and irritability. Should such symptoms arise during a cautious and gentle examination, the conclusion that the mucosa is diseased is reasonable and proper, although not final. The latter point is reached only by urethroscopic examination of the entire mucosa when the instrument may be passed through the stricture or of the distal membrane when only its face may be reached. The dilating urethrometers, of which the Otis is the best type, may be used for some of these functions, in that the shaft of the instrument collapsed will pass rather small strictures. It is of 15 Fr. diameter closed and 45 Fr. diameter when extended. The natural elasticity of the urethra both in health and, in many instances, in disease and the tendency of pouch-formation proximal to strictures both make the accuracy of this instrument uncertain, because the power exerted by its screw is so great, through no fault in its design, that the resistance of the canal is not transmitted to the operator with sufficient definiteness for mensuration. It is for this reason that the writer considers this type of instrument not an essential part of the urologist's armamentarium.

The elasticity of the stricture is suggested only by noting whether closure of the canal to its original diameter slowly or quickly follows the use of exploring instruments of known caliber.

Laboratory analysis of shreds and discharge associated with stricture and obtained from the urine or through a urethroscope reveals the gonococcus on smear and culture with its allies and proves the safety or danger of treatment. The gonococcal complement fixation test, if positive, demonstrates absorption from the lesion and treatment through the various methods—such as dilatation and internal or external urethrotomy—is often the finality of the anatomical diagnosis.

**Differential Diagnosis.**—The differential diagnosis is interested in distinguishing gonococcal organic stricture from the various other forms, especially stricture by trauma, spasm and extraurethral pressure.

*Inflammatory differs from gonococcal stricture* in the history of a very acute infection which duplicates the gonococcal invasion in its severity and sudden onset; in its subjective symptoms of inability to urinate, and excessive pain due to inflammation of the urethra and distention of the bladder; in its objective findings of great edema and swelling of the urethra as a whole and especially on rectal examination, and of the distended bladder by palpation and percussion above the symphysis; in its laboratory determination of the offending organism with absent gonococcal fixation test; and in its rather ready relief by rest, sitting baths, decongestants, sedatives, penile baths and hot packs with the absence of organic fibrosis on exploration after all symptoms hav



sided and cure is established. It should be remembered that intense gonococcal infection may produce this form of stricture—stricture by uremia—which must then be distinguished from the organic type by this last test, that is, exploration after cure is otherwise established.

*Spasmodic differs from gonococcal stricture* in the admission of urethral exploration and of nervous defects of the patient toward any medical or surgical examination; in its subjective symptoms of inability to urinate even after great strain and objective absence of nodes of the urethra externally by palpation or internally by instrumental investigation with presence of obvious muscular spasm perceived through the rectum along the compressor urethræ muscle; in its laboratory findings of present or absent inflammation or infection in agreement with the incidence of these lesions as the sources of the spasm rather than mere instrumental reflex irritation and accordingly with the absence of the gonococcus and the complement fixation test and in its ready relief by simple treatment with rest in bed, hot baths, anti-spasmodics and temporary cessation of instrumentation, whose later success proves the absence of organic stricture.

*Periurethral pressure differs from gonococcal stricture* in the history of growth associated with urethra, prostate or rectum; in its subjective symptoms of slow onset in chronic conditions, such as neoplasms, or of rapid appearance during acute lesions, such as extravasation of urine or hematoma; in the objective presence of the new growth or accumulation of urine or blood with the obstruction, but absence of discharge from the urethra; in its discovery of the contents of the mass as solid or fluid, blood or pus, by aspiration, in the laboratory development of no infection, no urethral pus and no blood unless abscess is present or a neoplasm has ulcerated into the canal, and of proof of no gonococci on smear or culture or no positive complement fixation test and in the final anatomical diagnosis by removal of the growth in whole or part and evacuation of the fluid by incision and drainage, of which both may be followed by a pathologist's examination.

*Traumatic differs from gonococcal stricture* in its history of recent or old injury with obvious and characteristic conditions arising therefrom; in its symptoms of intense severe sudden onset in recent trauma or of slower though intense establishment in remote injuries, with the objective signs of the injury in new cases or of dense scar, extraurethral or intraurethral, in old cases; in its laboratory findings of little or no pus, no gonococci or other pathogenic organisms, on smear or culture and no complement fixation test; in its demonstration in the treatment of a dense scar extending into the annexa in old cases and of obvious lacerations of the part in recent forms.

## CHAPTER VII.

### TREATMENT OF STRICTURE OF THE URETHRA. URETHRAL INFECTIONS IN CHILDHOOD AND OLD AGE. COMPLICATIONS OF STRICTURE.

**Significance.**—Stricture is one of the most important urological conditions and requires judgment and care for results. Its treatment may be considered under the usual headings of preparation, prevention, management, alleviation, cure by nonoperative and operative measures, aftertreatment and accidents of treatment.

**Preparation of the Patient.**—Except emergencies and the field itself, which must be dealt with according to well-known principles, the preparation is both systemic and local. The general measures include light diet, no alcohol or other stimulants in order to keep the renal function at rest, and directions to the patient for securing quiet, both bodily and sexual, during the treatment, and arrangements for confinement to bed in the more severe and operative conditions. Urinary antiseptics should be administered for several days previously in order to render the urine bland and safe, and to flush out the urethra with urine charged with antiseptics. The local preparation involves the application of decongestants like adrenalin, weaker antiseptics like 2 or 4 per cent. boric acid water, or 1 in 3000 nitrate of silver, astringents of which none is better than silver nitrate and hot penile sitting and body baths, which act both locally on the urethra and generally on the skin to the relief of the kidneys.

**Prevention.**—It is necessary to include instruction of the patient and measures to limit the penetration of the urethritis as far as possible. The patient should have instruction by reprints, other pamphlets or printed circulars setting forth the importance of chronic urethritis and the tendency and significance of stricture.

#### INSTRUCTIONS ON CHRONIC GONORRHEA AND STRICTURE.

**Chronic Gonorrhea.**—Chronic gonorrhea is the uncured final stage of the acute gonorrhea. It is also known under the terms of gleet, chronic urethritis, clap, chronic drip or drippings, etc. All these words mean the one and same disease.

Chronic gonorrhea means that somewhere in the urinary canal severe damage has occurred to the lining or mucous membrane, to few or many of the minute glands which furnish the moisture of the mucous membrane, or even to such important parts of the sexual apparatus as the prostate gland. Any one, any two, or all three of these conditions may be present. This constitutes chronic gonorrhea and is on

of the most important venereal diseases because unless cured it leads to progressive conditions, especially stricture, as briefly explained on page 266.

Chronic gonorrhea is also the source of infection of many innocent persons of the opposite sex in marriage. Infection of women in this way accounts for fully 50 per cent. of all operations for abscesses of the ovaries.

The most constant symptom of chronic gonorrhea is a slight drop varying in amount and frequency and in color from yellow to whitish. It is most abundant in the morning upon arising. Sometimes there is also a sense of discomfort in the canal. This drop washes away with the urine and largely accounts for the so-called "floaters," "shreds," and "threads" in the urine.

**Stricture.**—Stricture of the urethra is any obstruction of the size of the urinary canal, open or close in degree. Stricture is also any change in the natural form or course of the urinary canal, great or small. Stricture is caused by injury or disease, and necessarily includes a permanent lifelong change in the lining or mucous membrane of the canal and of the structures just outside the canal. In other words, stricture is a callous spot or permanent scar of previous injury or disease in the canal.

The danger of stricture is that it makes a backset against the flow of urine, like a dam in a stream, which is felt by the urinary passage, then by the bladder, next by the tubes leading from the kidneys to the bladder, called the ureters, and finally in severe cases by the kidneys themselves. It is not necessary for the urine to be entirely shut off in order to make a stricture a very dangerous condition. Stricture gives about the same symptoms as chronic gonorrhea, combined with at first slight then great changes in the size and form of the urinary stream. A most careful examination should always be made of the stricture, and if one is present even in moderate degree gentle treatment of it is necessary. Nature never intended the urinary apparatus to work against the disadvantage of obstruction along the course of the stream of urine.

**Treatment of Stricture.**—Most strictures may be stretched open until the passageway is restored to its natural form and size, but since strictures are only scars, their tendency is to cause fresh difficulty unless they are watched. Therefore it is necessary to pass an instrument through the passageway three or four times a year throughout life in order to prevent a return of the stricture.

Educational measures include a circular employed in the writer's clinic with very great advantage. The most important direction for the patient is strict obedience to orders and abstinence from self-treatment which almost always involves hand injections of too great concentration and too frequent use. A safe rule is that no hand injection or application should be used whose ardor and astringency persists more than a few moments and that without definite spasm or other disturbance of the bladder. Almost every urethritis during

the first month after recovery will leave behind it soft infiltrations which usually disappear if left alone. They almost always become fibrous if sounds are passed prematurely, roughly, or of too large diameter. Thus an important element in the prevention of stricture is conservatism in the use of instruments with relation to convalescence, size and method of employment. Again, another factor in prevention is the patient's own conduct in the avoidance of sexual, dietetic and alcoholic excess, during any part of the urethritis, which will always augment existing conditions and frequently induce new manifestations.

Management during the treatment distinguishes the operative and the nonoperative cases. Chapter IX, on General Principles of Treatment, supplies the requisite data of this subject in every detail.

The management of operative cases varies with the form of operation and therefore will be described as an essential of the technic of each operation in subsequent pages.

The operative cases should all be in bed until the wound is well granulating, and during this period they should receive the usual nursing, diet and medication for urological conditions, with special reference to the condition of the kidneys. If these are affected at all the rest in bed, the quiet of the urinary canal through relief of the obstruction and drainage, suitable urinary antiseptics, sedatives and diuretics and dietetics will accomplish marvels in many cases. The author has found the following simple formulæ of service.

As antiseptics:

R—Hexamethylenamin . . . . .	gramme 0.3	(grains 5)
Salicylate of soda . . . . .	gramme 0.3	(grains 5)
Distilled water . . . . .	gramme 0.06	(dram 1)

Mix and mark:

Dram 1, in a glass of water, every two to four hours.

Or combined with salicylate of soda in the foregoing formula, acid phosphate of soda may be used in equal or double quantities.

This formula is of special value in the colon bacillus infections of the kidney and bladder, and its dose may be increased temporarily as desired. Instead of the formin, other formaldehyde preparations may be employed. Urinalysis should be periodically made during the administration of such formaldehyde drugs because this chemical may irritate the kidneys profoundly, producing bleeding and casts, and should then be discontinued. In such an event the older urinary antiseptics should be tried.

As sedatives:

R—Acetate of potash . . . . .	grammes 1.20	(grains 20)
Tincture of hyoscyamus . . . . .	gramme 1.00	(minims 15)
Distilled water . . . . .	up to grammes 4.00	(dram 1)

Mix and mark:

Dram 1 or 2 in a glassful of water every two to four hours.

R—Fluidextract of triticum repens,		
Fluidextract of uva ursi . . . . .	of each grammes 46.50	(ounces 1½)
Liquor of potash . . . . .	grammes 15.50	(ounce ½)
Distilled water . . . . .	up to grammes 124.00	(ounces 4)

Mix and mark:

Dram 1, in water, two hours after eating and during the night.

Both these formulas are diuretics and antacids, neutralizers and alkalizers according to the amount administered.

The bicarbonate of soda grains 5 to 30 from three to six times a day may act in the same manner.

As diuretics:

R—Acetate of potash . . . . . gramme 1.00 (grains 15)  
Distilled water . . . . . up to grammes 4.00 (dram 1)

Mix and mark:

Dram 1 or 2, in water, every two to four hours, or three times a day two hours after eating.

R—Citrate of potash . . . . . gramme 1.00 (grains 15)  
Syrup of lemon . . . . . grammes 2.00 (fluidram  $\frac{1}{2}$ )  
Distilled water . . . . . up to grammes 4.00 (fluidram 1)

Mix and mark:

Drams 1 or 2, in a glassful of water, every two to four hours.

Simple lemonade and the judicious drinking of plain or medicinal waters are also good diuretics. Among the latter the best are French Vichy and Swannee Water. "Imperial drink," consisting of cream of tartar, ounce 1, lemon juice and water up to a pint is also a good diuretic.

The dietetics of all these operations is the standard for other surgical interference, combined with that specially adapted for nephritis, and need not be here discussed.

The management of the nonoperative cases, that is to say, of the patients under dilatation, requires in general much the same details as for subacute urethritis, because the regular instrumentation of the canal, at least at first, until the lumen of the infiltration has been advanced sufficiently for good drainage, is very apt to provoke a mild subacute reaction. The patients are, therefore, put on a mild non-irritating diet, urinary antiseptics, blennorrhetics, and occasionally hand injections. If the stricture is quite tight they are sent home to bed or quiet for the rest of the day, a step which makes the evening office hour the best for such treatment because the patient may then return home for a light supper and a long night's rest, preferably after a hot sitting bath, which often tends to prevent stricture by edema for a short time after the dilatation. Such a sitting bath may be conveniently taken in an ordinary tub if the patient has no special sit-bath fixture, by drawing about twelve inches of hot water into the standard tub, in which the patient sits with his lower extremities extended and the water up to his navel. The heat of the water should be sufficient to leave the skin distinctly congested in a high pink color and the bath should be continued for about twenty minutes, after which he retires at once to bed.

The diet, antiseptics, and blennorrhetics have been sufficiently described in pages 67 and 68 and need no addendum here, a hand injection, rarely needed if gentleness and deliberation in the dilatation

are followed, had best be of the astringent type, and none is better than the full or half-strength U'tzmann injection:

R—Zinc sulphate . . . . . grains 6 to 12  
 Lead acetate . . . . . grains 6 to 12  
 Distilled water . . . . . up to ounces 6  
 Mix and mark:  
 Inject carefully as directed from two to four times daily.

The directions for hand injections for the patient are advisedly set down in a printed circular which is given on page 56, under the treatment of gonococcal acute urethritis. In stricture cases the sit-bath and the irrigation of the urethra by the urologist directly after the passing of the sound with hot normal salt solutions, 1 in 5000 adrenalin solution, 2 to 4 per cent. boric acid water, potassium permanganate solution, 1 in 10,000 to 1 in 4000, argyrol 5 per cent., protargol 1 per cent., all with a temperature of 105° to 120° F., according to tolerance, will itself reduce the likelihood of edema and temporary closure of the canal; but most important are the gentleness of manipulation and the infrequency of treatment as hereinafter detailed. The special catheter sounds of the author, permitting filling of the bladder with irrigation and the flushing of the urethra by the patient himself, are here serviceable.

The alleviation treatment is largely the effort to control the urethritis and other accompaniments of stricture or its complications. All the foregoing formulas have their function in this field and must be applied in accordance with the condition predominating.

The curative treatment is subdivisible into nonoperative and operative measures, a distinction which rests solely on the administration of anesthetics and a distinctly cutting operation instead of dilatation of the canal with various means—a process, however, which should command respect fully as much as the more directly operative procedures.

**Immediate Indications of Treatment** are to relieve the closure, deformity and inflammation of the urethra, to evacuate the retention of urine, even though partial, to remove the back-pressure or tendency thereto, to heal the diseased mucosa wherever involved in the urethra, bladder or upper urinary organs, to prevent and cure any of the severe complications, and finally to reach the cause of the stricture when possible. The remote indications are to prevent relapse of the stricture itself, its effects and complications. The application of the various methods of treatment to these aims will be sufficiently obvious in the description of the various procedures.

**Methods of Treatment** are as stated nonoperative and operative, in each of which several have been approved and disapproved. The approved nonoperative methods are: (1) gradual dilatation, (2) continuous dilatation and (3) electrolysis, and the recognized operative measures are: (1) dilating urethrotomy, (2) internal urethrotomy, (3) combined external and internal urethrotomy and (4) excision. The disapproved nonoperative steps are: (1) caustics and (2) divulsion, and

obsolete operative procedures are: (1) forcible dilating urethrotomy and (2) subcutaneous section.

**Disapproved Nonoperative Methods.**—All the caustics are under absolute condemnation because they replace the ordinary inflammatory deposit constituting the stricture and often not fibrous with a chemicalumatic cicatrix which is always fibrous and among the most difficult infiltrations to treat in that it extends beyond the mucosa into the corpus spongiosum and the periurethral planes. Caustic potash seems the past to have been commonly employed by various special instruments called *portes caustiques* or caustic porters. Divulsion is also obsolete in that it is a coarse traumatism, very irregular in action, uncontrolled in limits and disrespects the possibilities of infection and septic absorption. It consists in passing a dilating instrument through the stricture and, at one sitting, with or without local or general anesthetics, opening the blades and restoring the caliber of the canal. The foregoing objections to it are at once manifest.

**Disapproved Operative Methods.**—A procedure on the border line between the proper and the improper types is dilating urethrotomy, which is a combination between divulsion and internal urethrotomy. It is the former element of undue dilatation which is the disapproved procedure on the same grounds as divulsion itself. If, however, this particular step is limited to ordinary tension of the stricture upon the point of the urethrotome, then the operation is really modern internal urethrotomy, and is by no means unfavorably regarded, and its details are discussed on pages 390 to 395. Subcutaneous section by which effort is made to divide the offending band by a more or less stabbing operation through the skin is also an unguided and condemned operation without advantageous feature.

With this dismissal of the improper methods of treating stricture, the application of the approved technics will be shown with relation first to their own indications and second to the various types of stricture and their complications.

**Comparison of Dilatation and Operation.**—In general, indications show that it is a good rule to make reasonable effort to dilate all strictures.<sup>1</sup> Exceptions to this rule are: (1) when drainage is indicated as a means of benefiting the posterior urethra and bladder; (2) often when the stricture is smaller than 7 Fr. in caliber, because most of this class of strictures are complicated and benefited by open operation; (3) when a stricture is highly elastic and does not remain dilated and (4) when complications coexist with the stricture. The following other general principles as to choice between dilatation and operation are applicable and explicable:

1. Gradual dilatation is the preferred method in all succulent, non-inflamed, elastic newly acquired stricture. Diameter of lumen and position of the stricture in the canal do not affect this rule. The important point is the recency of the stricture. If intervention with newly formed infiltrations is begun too soon, they will be stimulated to form a

<sup>1</sup>Pedersen, V. C.: Jour. Am. Med. Assn., January, 1910, and Am. Jour. Urol., March, 1910.



traumatic stricture, whose character will vary according to the nature, frequency and violence of the treatment and the reaction of the patient's tissues in such cases.

2. Continuous dilatation is advisable in tight stricture without irritability or complications, permitting only a filiform to penetrate them. One or two filiforms are left *in situ* for twenty-four or forty-eight hours, during which they will by expanding under the moisture of the canal dilate it to 7, 8 or 9 Fr., after which the tunneled and grooved irrigating sounds of the writer may be employed. If the bacteriology of the stricture shows infection, or its behavior irritability, this plan cannot be adopted. If, at the end of forty-eight hours, no yielding has occurred so that an instrument may be threaded over the filiform, continuous dilatation had best be abandoned, otherwise infection of the bladder and even ulceration may supervene by pressure effects of the coiled filiform upon the mucosa.

3. Electrolysis is often regarded as a disapproved method, but in the hands of experts with suitable apparatus it should be regarded as one of the accepted methods, in that its softening and relaxing action are of great advantage in selected cases. A great difficulty is that electrolysis by modern methods requires expensive and somewhat cumbersome apparatus in order to provide the variety, range and control of the currents. It cannot be properly applied by small and cheap apparatus, which might be designated as electrical or scientific toys. On the other hand, electrolysis is not to be regarded as a kind of cure-all method, but as a method with distinct limitations.

(4) Internal urethrotomy will relieve all cicatricial, irritable, highly elastic strictures in the anterior urethra, including the bulbous urethra and is applied along the roof, excepting at the meatus where the incision is only along the floor. Dilatation fails in stricture of the meatus, so that meatotomy alone will relieve an infiltration causing symptoms. Before internal urethrotomy is ever attempted except in emergencies, a bacteriologic examination should be made of the pus present. If vicious germs are found, local treatment should be attempted for their destruction, if possible, before any operation whatever is practicable.

5. External perineal urethrotomy with a guide or perineal section with a guide is available for all cicatricial, irritable, highly elastic infected or complicated strictures of the posterior urethra, whether in the membranous or prostatic portions. One of the greatest indications of external urethrotomy is the presence of pus which would be benefited by the drainage of this operation and the same basic principle applies to the following paragraph.

6. Combined internal and external urethrotomy is indicated in dense cicatricial strictures of the anterior urethra with such complications as fistula and false passage, inasmuch as the drainage of the perineal tube permits the complication to be treated surgically or otherwise.

7. External perineal urethrotomy without a guide, or perineal section without a guide will relieve the deep impassable stricture. Urethral injection of dye-stuffs, such as indigo carmine, will often re-

out the tortuous course of urethra or if such exists, of false passage or fistula and render the operation easier. Suprapubic retrograde passage of filiform or guide by Sinclair's method or by the method of suprapubic cystotomy is often necessary to bring the proximal and distal portions of the urethra into proper anastomosis.

8. Excision of the stricture or urethroplasty is necessary for impassable nodular, scar tissue strictures completely replacing the walls of the canal. The lumen of the passage is restored either by partial suture or transplantation of mucosa in the method described on page 407. On the other hand, it is noted that the majority of strictures are inflammatory and that the end result of any excision operation must in greater or lesser degree be an annular traumatic stricture, which probably without single exception, is the most intractable form of stricture. Therefore, the application of excision is deservedly a question of the greatest possible doubt.

**Comparison of the Various Types of Stricture for Dilatation and Operation.**—The following facts are revealed in such a study:

1. Strictures of the meatus with symptoms require meatotomy always along the floor and at times meatal internal urethrotomy.

2. Open strictures from 19 Fr. upward, and close strictures from 10 to 19 Fr. both inclusive, indicate gradual dilatation. In the anterior urethra the elasticity of the tissues may require internal urethrotomy, but in the posterior urethra such elasticity rarely occurs and the infiltration may be relieved without internal urethrotomy.

3. Tight strictures, 9 Fr. and smaller, may often call for gradual dilatation unless combined with urethritis or a complication, when open operation and drainage are required, especially in the deep urethra. Internal urethrotomy is often the sole means of their relief in anterior urethra.

4. Impassable strictures require combined external and internal urethrotomy excision and urethroplasty, if not extensive. Sinclair's method or the older suprapubic cystotomy and retrograde sounding of the deep urethra to the stricture are often required.

5. New succulent uncomplicated infiltration if not less than one or two months old, should be dilated.

6. Irritable infections, cicatricial deposits with urethritis, other complications such as urinary fever, abscess, sinus and sepsis always require open operation and drainage.

With this brief review of the various forms and indications of the treatment of stricture the detailed technic of each remains to be considered.

## NONOPERATIVE TREATMENT OF STRICTURE.

### Dilatation.

**Varieties** are two: (1) *Gradual dilatation*, by which is meant the passing of instruments of slowly advancing diameter at definite periods whose interval is determined by the character of the stricture itself,

and its behavior under this treatment; and (2) *continuous dilatation*, by which is implied the passing and residence of an instrument in the stricture and bladder for a day or two. It is applied to the use of whale-



FIG. 96.—Gravitation.

bone filiform guides in tight strictures without irritability, infection or complications.

**Indications.**—Aside from the following special principles it is well to remember that it is a good rule to make a reasonable effort to dilate



FIG. 97.—Elongation.

all strictures. Exceptions to this principle are (1) when drainage is indicated as a means of benefiting the posterior urethra and bladder; (2) when the stricture is smaller than 7 Fr. in caliber because most of these cases are complicated and are benefited by open operation; (3)

icture is high elastic and does not remain dilated, and (4) complications coexist with the stricture. The following other principles as to choice between dilatation and operation are



FIG. 98. —Elevation.



FIG. 99. —Depression.

ts.— For dilatation there are two classes of instrument  
 1) woven or flexible and (2) metal or rigid. The flexible  
 include whalebone filiform guides, woven filiform guides,  
 whalebone dilators, V. C. Pedersen's whalebone dilators,

woven olive-pointed dilators, preferably those with cores filled with lead shot, woven olive-pointed catheters and an assortment of woven catheters. The metal instruments are, by choice, the author's tunneled



FIG. 100.—Penetration.

and grooved irrigating sounds and irrigating standard sounds and Kollmann's mechanical dilators, either irrigating or nonirrigating.

*Author's Irrigating Standard and Béniqué Sounds.*—Irrigation of the bladder after passing a sound may be done with silver or other



FIG. 101.—Rotation.

type of catheter, as described in subsequent paragraphs on page 374, as the "Two-journey Plan," with the disadvantage of two procedures to accomplish one object, which should be combined with the passing of the

elf, as stated in the original discussion by the writer.<sup>1</sup> After  
ble study and experimentation, a sound has been produced  
responds to the following description from No. 18 F. upward.



FIG. 102.—Evacuation.

igating tube is a silver catheter, of the same size for the entire  
Fr. It runs through the shaft from the base of the curve to  
e of the handle, at which it receives the rubber tube from the  
Actual practice shows that the necks of most bladders seize

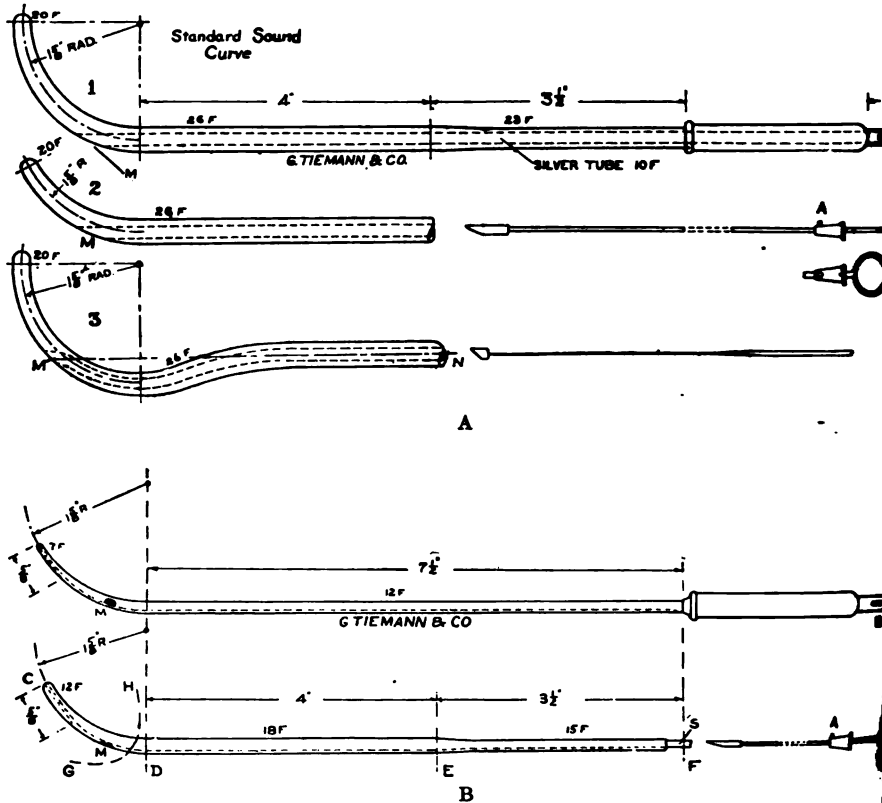


FIG. 103.—Irrigation.

in front of the opening so that the irrigating fluid is delivered  
on the floor of the bladder. In a few bladders it is necessary  
re sound in, or to rotate it or to depress the handle in order

<sup>1</sup> Trans. Am. Urol. Assn., 1909, p. 111.

to disengage the opening of the tube from the mucous membrane. The diameter of the silver catheter, 10 F., is ample for evacuation of thick contents and for irrigation with due rapidity.



Figs. 104, A and B.—Author's irrigating standard and Béniqué sounds and tunneled and grooved irrigating sounds. Nos. 7, 8, 9, 10, 11, 12 are made of steel tubing, nickel plated, opening on side in order to clear the groove (*M*, Fig. 104, A). Nos. 13, 14, 15, 16, 17, 18, 19, 20 open on the convexity of the curve (*M*, Fig. 104, B). Nos. 8, 9, 10, 11, 12 taper to 7 at the end, in Nos. 13, 14, 15, 16, 17 the taper is six numbers uniformly (Fig. 104, A). Only No. 18 and larger are double tapered in a No. "N" sound, the curved portion, i. e., between *C* and *D* would increase from "N-6" at *C* to "N" at *D*, the portion between *D* and *E* is of uniform circumference "N," and the portion between *E* and *F* is also of uniform circumference but smaller, i. e., "N-3" (Fig. 104, B). In all sizes the diameter of tunnel and groove, the handle and the rubber hose fitting are the same. No. 13 and larger have a silver tube (5), which is the same in all sizes, 7 Fr. (Fig. 104, B.)

The nipple is of uniform size for the entire set and is tipped with a cone-shaped collar for rubber tubing an inch in diameter. This uniformity saves trouble in connections, as this size of rubber tube is common on irrigators and hand syringes.

The handle is the shell-variety commonly set on many instruments, and does not vary from sound to sound.



The shaft is of the double taper type introduced by Dr. Chetwood.<sup>1</sup> The first  $3\frac{1}{2}$  inches next to the handle are three sizes smaller than the main shaft, which then passes forward at full size for 4 inches until the base of the curve is reached, thus making the straight shaft  $7\frac{1}{2}$  inches long.

The curve is on the radius of the nonirrigating standard sound  $1\frac{5}{8}$  inches. The length of the curve is a trifle more than  $90^\circ$ , which is also standard. The taper of the curve is uniformly 6 sizes from the base to the tip, so that, for example, size 26 F. is 20 F. at the beak. In the writer's experience this taper is the most convenient because the curve is almost entirely through the stricture before dilatation begins.

In Béniqué sounds the first degrees of the instrument are also tapered 6 sizes, so that, for example, a No. 26 F. instrument is 20 F. at the point. The catheter passes along the curve to a point corresponding with a straight line projected through the straight shaft until it cuts the curve. Thus the point of emergence will be just above the bladder floor, as in the other two forms. Although in the Béniqué sound the tunnel is not straight, in having only end-openings it may readily be cleansed. The obturator is of the form described excepting that the first few inches of the shaft are of flat spring-metal.

The obturator consists of a small plug ground to fit the opening at the base of the curve, mounted on a long, rigid wire with a loop handle. A little metal plug fits into the lumen of the nipple, thus steadying the obturator at this point. In order to prevent the obturator from twisting, a device like a simplified bayonet-catch has been provided between the nipple and the handle of the obturator. In order to prevent the sharp corner of the obturator seen in AA, Fig. 104, from projecting and cutting the patient if in the inverted position, the slot of the bayonet-catch has been made very long and the plug on the handle of the obturator set forward a corresponding distance. Thus if the obturator is wrongly inserted the plug will prevent the obturator from being seated home at all until it is rotated so that the peg is in the slot. When the obturator is set, in order to prevent any sharp edges the surface of the obturator has been convexed and the opening in the silver tube concaved.

**"One-journey Plan" of Vesical Irrigation.**—These sounds permit this technic perfectly.

The manner of using irrigating sounds is as follows: After thoroughly boiling, the obturator is examined to see that it is freely movable and then pushed into position and locked. The sound is then lubricated and introduced into the urethra in the usual manner. It is well to place the little finger through the loop in the handle so as to be sure that the obturator does not slip. For the same reason it is also well to make the final pressure upon the sound by means of the obturator-handle, which is stout enough to permit thereof. After the sound has remained in five or ten minutes the obturator is withdrawn and a flow of urine follows, and a receptacle should be at hand to catch it.

<sup>1</sup> Chetwood and Keyes: *Venereal Diseases*, 1900, p. 126.

The irrigator, previously filled with warm antiseptic fluid, is connected with the nipple gently so that chafing the bladder with open end of the channel shall not occur. It is best to have a three inch piece of rubber tube to slip over the nipple readily, but wat tight. Into this the conical tip of the syringe or irrigator may slipped without disturbing the sound. Although simple, this is an important detail.

Under gentle pressure a few ounces of fluid at a time are run in and out of the bladder. If the flow does not immediately start it probably due to the fact that the mucous membrane of the bladder floor lies too tightly against the bladder end of the tunnel. Correction of this difficulty has already been noted under manner of introduction. After the bladder has been irrigated it is finally filled with the fluid and the sound without the obturator is withdrawn. The patient is then allowed to evacuate the antiseptic at once or to carry it away with him in his bladder for evacuation a quarter-hour or a half-hour later.

The results of using irrigating sounds are not only protection against dangers of sound-passing, but distinct promotion of the comfort and reassurance to the patient. The intelligent patients state that they never have felt so comfortable after the passing of a sound as after these irrigations and evacuations of a warm simple antiseptic fluid.

*Irrigating Tunneled and Grooved Sounds.*—The necessity of always washing bladder and urethra after instrumentation led the writer to devise an irrigating tunneled and grooved sound laid down on the line of the original Van Buren-Gouley sound. Hitherto the only irrigating instrument which might be used as a sound was the silver catheter. The writer has devised a tunneled and grooved sound by taking two steel tubes for the small sizes and by cutting a segment out of the wall of each which when brazed together give the shaft of the sound, and the groove of the sound.

In order to preserve the plan of the irrigating standard sound just described, the curvature is uniformly of  $1\frac{5}{8}$  inches radius, the length of the curve is approximately 1 inch shorter than that of the standard sound. To compensate for this shortening of the tip the straight part of the shaft is elongated 1 inch. The taper of the curve is uniformly six French numbers in all sizes from 13 to 20. Sizes 8 to 12 inclusive, however, taper to No. 7 at the point. By this plan of six size taper where possible the dilatation is made very gradual. For example, size 18 F. is at the tip 12 F., at the middle of the curve 15 F. and at thirds of the distance between the tip and the middle of the curve 13 and 14 F., respectively, and at thirds of the distance between the midpoint and the straight shaft 16 and 17 F., respectively. Also, for example, size 10 F. is 7 F. at the tip and  $8\frac{1}{2}$  F. at the midpoint, and so on for the whole series of sounds. This careful uniformity of taper is of great service in using the sounds, for a stricture which has taken 8 F. will accept almost the half-beak of the 10 F. instrument before the real dilatation begins, and a stricture which has

an 16 F. will engage almost two-thirds of the beak of an 18 F. and before stretching ensues. Thus far greater safety in the use of the instruments is gained.

It is not necessary to have an office set consisting of all sizes. The author has found the even numbers sufficient, namely, 8 to 26 F., inclusive. Ordinarily No. 20 F. would be the largest required. Two patients, however, who refused urethrotomy had dense extensive strictures which required for safety the other numbers of the series stated, namely: 22, 24 and 26 F.

The shafts are of uniform size from the base of the curve to the handle until size 18 F. and larger are reached. Then the double-taper plan of Hewitwood is used.

The tunnels of the tips are of uniform diameter from the smallest to the largest sounds, namely, a trifle over the diameter of the ordinary Halebone filiform guide. This plan prevents wobbling of the larger sizes upon the filiform and accustoms the operator to a uniform feel of the action of the sounds in passing along the guides—a very important detail. All tunnels are, moreover,  $\frac{5}{8}$  inch long, which gives relatively extensive cones for the tips of the sounds. The long-tunneled tip follows the direction of the filiform better and really prevents the tendency of short tunnels to cut or buckle the filiform.

The grooves begin at the proximal ends of the tunnels and extend throughout the shaft to the handle and are likewise of uniform width and depth, *i. e.*, large enough to accommodate the standard filiform guide. This excess of space between the filiforms and the grooves is ample for the purposes of urethrotomy, namely, of guiding the knife and the director, should such be necessary.

Irrigation is provided for in sounds No. 13 F. and larger by silver catheters of uniform size (7 F.) extending from the base of the curve of the tip to the rubber hose-fitting in the handle and opening into the groove at the base of the curve. Sizes 7 to 12 (both inclusive) are allowed throughout and in order to clear the groove have the opening on the side also at the base of the curve. This is necessary because a separate silver tube could not be incorporated into such small sizes.

The handles of the sounds, including the hose-connections and the obturators of the sounds, are the duplicates of the types used in the standard sounds described in the first part of the article.

The advantage of irrigating tunneled and grooved sounds lies in the fact that it permits treatment of the bladder through the same instrument used to dilate; in other words, instrumentation reduced to a minimum, which in most strictures is of extreme importance, because the reflexes due to irritation are matters of moment in all stricture-instrumentation.

The prevention of rust in the calibers of the small steel tunneled and grooved irrigating sounds requires that they should be dried as well as possible in dry heat, or have the moisture blown from them, and then the obturator, dipped deeply into the liquid albolene, should be seated home. In this way the lumen is kept free from moisture, lined internally and remains rustfree.

*Soft, flexible instruments for irrigation* are as follows: An olive-pointed woven catheter is taken and threaded over a woven dilator, common or lead-core. Into a very small size catheter whalebone guides may be passed with advantage as obturators. After the stricture has been passed the obturator is removed and the bladder duly filled. Fig. 105 shows the catheter with its lead-core dilator as obturator seated fully home. It will be noted that the gentle cone of the tip of the catheter is followed by a small area of its length corresponding with the tip of the dilator, which is relatively less supported by the dilator. This "give" or compressibility only adds to the gentleness of the dilatation and is an advantage. As a rule, a difference of about 6 to 11 sizes French occurs between the outside diameter of the catheter and that of the dilator; for example, a 22 F. catheter has a bore of 12 or 11 F., and therefore needs a dilator of either of these sizes.

**"Two-journey Plan" of Vesical Irrigation.**—In irrigating the bladder during dilatation of stricture another method is the "Two-journey Plan." The dilator is passed, and after remaining the required time, withdrawn, and a catheter of slightly smaller size substituted. This double invasion of the passage is to be avoided whenever possible, but, after all, it is better than the omission of the artificial urine in



FIG. 105.—A B, represents the olive-point, woven, lisle-thread catheter, and C D represents the cone-point, lead-core, woven, lisle-thread dilator, used as an obturator, seated home in the lumen of the catheter, extending from the open funnel-end D, to the eye at E. The failure of the point of the obturator to support the wall of the catheter just back of the eye is clearly shown, E F.

order to sterilize the bladder and wash out the urethra. The use of the irrigating sounds in order to accomplish the same ends is familiar from the previous description.

There is analogy between the Two-journey Plan, noted above, and the technic of the old-fashioned nonirrigating cystoscope, which required the bladder to be prepared before and frequently after the cystoscopy with the help of a catheter. This necessitated the passing of two instruments, and if bleeding followed the introduction of the cystoscope the field could not be cleared through the sheath of this instrument but only through a catheter reintroduced after withdrawal of the examining instrument. The disadvantages of this doubling of the offense to the urethra and bladder are at once obvious, especially when one remembers that they are both irritable structures when inflamed, as is often the case in patients requiring cystoscopy or dilatation of stricture. The irrigation of the bladder through the chief of the cystoscope or through the silver catheter within the irrigating sound is at once a rational procedure, and by leaving the bladder full of irrigating fluid the patient in Nature's own way irrigates his own urethra, quiets traumatism, and limits reflex action.

**Selection of Type of Dilator.**—Selection of dilator means, in other words, woven and flexible, versus rigid and metallic forms. The factors of the decision in brief are the extent of the stricture along the urethra, the thickness of the stricture walls, the tortuosity of the lumen and the amount of the discharge (partially synonymous with the degree of inflammation present). Long, thick, tortuous and irritable or inflammable strictures certainly indicate soft instruments until they are raised to size 20 French in diameter, when they are open strictures, and may frequently be benefited by resort to steel instruments. Relapse of a stricture after a cutting operation is usually very tortuous, thick, inelastic and dense, and requires soft instruments. Sometimes only the soft instruments may be used, no matter what the diameter of the stricture may be. This is particularly true where the tortuosity or alteration in the course of the canal is great. Frequently a stricture which, without pain, takes a 28 French flexible instrument, refuses a 24 French steel instrument, excepting at the cost of force and pain. The reason is at once obvious: the steel instrument not only dilates the caliber centrifugally, but also spreads the canal forcibly from great tortuosity to a relatively straight line. In these cases the use of a steel instrument is a mistake, because it causes sufficient traumatism to add to the scar tissue. Stricture of the prostatic urethra and neck of the bladder, following prostatectomy, always requires soft instruments. Strictures which cover a short length of the canal are bandlike or ringlike in form, and are best treated with steel instruments. Tortuous strictures, with thin walls, after having been dilated with soft instruments, are not uncommonly benefited by steel instruments and massage.

**Forecare of the Patient.**—The surgeon must be concerned in the treatment of the kidneys, urine and urethra, and embrace the administration of urinary antiseptics and of reasonable irrigation of accessible urethral mucous membrane. The preliminary attention to the stricture itself concerns the local use of styptics (adrenalin), antiseptics (weak solutions of nitrate of silver) and at times local anesthetics (weak combinations of cocain, eucaïn and alypin). Meatotomy is an important step, not only for permitting the passage of suitable instruments, but also for granting due drainage of the canal. There is no doubt that a small meatus invites stricture in the third region of the urethra by retarding the drainage of gonococcal pus, and thus by increasing the penetration of the disease.

**Gradual Dilatation.**—**Institution.**—The time for beginning gradual dilatation of stricture is the same as the interval advised between separate treatments, that is to say, from three to seven days after the original diagnostic examination, which is in itself usually a distinct dilatation through the employment of bougies-à-boule, urethroscope, sounds and the like. The shorter interval may be taken in strictures without inflammation and many symptoms, but in the long run it is wiser to give the mucous membrane full recovery for a time between treatments. The interval is commonly not less than five days apart.

**Preliminary Meatotomy** is required whenever the meatus is so small as to give symptoms in itself or as to prevent the passage of any but instruments too small to benefit the proximal urethra. It is always performed on the floor of the meatus unless anatomical defect has laid down a shallow or deep reduplication of the channel which is usually dorsal and blind at its proximal limit. In such a case both dorsal and ventral enlargement of the meatus must be cautiously and completely done. Its technic is detailed under internal urethrotomy but the little wound should be allowed to heal fully before dilatation is begun, otherwise the irritation of the open incision will frequently provoke spasm of the deep urethra and neck of the bladder which will interfere with the subsequent steps. Part of the aftertreatment of meatotomy is to pass straight sounds through the enlarged opening until the epithelium has covered in the surfaces of the wound, otherwise closure of the incision and failure of the operation will follow. Intercurrent meatotomy is a term applied to enlargement of the meatus at a subsequent period of the dilatation of strictures which require immediate enlargement. When the latter has been carried up to the limits of the meatus, the outlet is incised in the usual way. Thus, in illustration, a close stricture of 12 Fr. may be brought up to the limit of the meatus, say 20 Fr., and this may be divided to 30 Fr. for the remainder of the treatment.

**Open and Close Strictures** which, as previously stated, respectively include 20 Fr. and larger, and 10 to 19 Fr. inclusive, are suited to dilatation with instruments without a guide in most cases. In selecting the first instrument the same diameter or one size smaller than the bougie-à-boule which has passed the stricture should be employed, and the sound left in place for at least five minutes. This treatment trains the mucosa not only to dilatation, but also to a certain amount of extension in that sounds do that which the bougie-à-boule does not, that is, stretch the urethra in length as well as in diameter; in other words, reduce the tortuosity as well as the narrowing of the infiltration. After tolerance has thus been developed, advance in diameter should be by one number, or at most two, so as to avoid divulsion of even moderate degree. When the limit of the meatus which is naturally one of the narrowest parts of the canal, as stated under this heading, is reached, the question whether or not intercurrent meatotomy should be done rests on the size of the meatus itself primarily, and on the behavior of the stricture secondarily. In other words, a distinctly small meatus must be opened, but a stricture which has been dilated to 25 Fr. as an illustration (because the meatus will not accept a larger instrument) and remains in perfectly good condition, does not ordinarily indicate a meatotomy, especially if a urethroscopy shows that the mucosa about the stricture is in good condition. If otherwise, either a meatotomy may be performed and the stricture dilated to 30 Fr., or a mechanical dilator, such as the Kollmann, may be employed for the remaining period or an internal urethrotomy performed with the Maisonneuve or Otis instrument, all according to results of study



of the lesion. Retention of the sound is for a period of five to ten minutes so as to induce complete and gradual destruction of the fibrous bands, by the principle now familiar to gynecologists that gradual stretching of os uteri is more lasting and safe than rapid. Irrigation of the bladder and urethra with the special sounds of the writer has already been justified.

**Methods of Gradual Dilatation** are two: (1) with rigid or metal instruments, and (2) with soft or flexible instruments. The best examples of rigid instruments are the steel sound, bougie-à-boule and silver catheter, and of flexible instruments the many types of silk and lisle-thread gum-elastic bougies-à-boule, dilators and catheters.

**Technic with Metal Instruments.**—The sound is taken as the type and the manner of passing it into the bladder without a guide through any stricture is as follows: Although a sound may be passed through the small calibers of close stricture, say from 10 to 16 Fr. caliber, both inclusive, it is hazardous to do so without a guide except with soft instruments which are in these cases to be preferred.

The following details are applicable to strictures anywhere in the canal and perhaps especially to those of the posterior urethra. There are cases, however, where the infiltration is in the anterior urethra alone, so far forward that it is inadvisable to pass a sound into the bladder. For such cases the curved sound may be passed only to the bulb or first step of bringing the instrument to the vertical position, preferably the technic of passing a straight sound should be employed.

The same preliminaries are respected and the instrument is allowed drop of its own weight into the urethra while the organ is held in the vertical position. By this step no part of the mucous membrane traversed more than that of the bulb and anterior canal, and any risk deeper invasion at once avoided. These sounds are also to be retained five to ten minutes.

After the preliminary examination has been completed and when possible urinary antiseptics given for a few days the patient makes his next visit, passes his urine, and is placed on the operating table with his feet apart, his underclothing drawn downward to the knees, and rolled upward to the ribs. With sterilized hands and instruments the urologist washes the glans penis and meatus with boric water, and then lubricates the sound and the canal. The most serviceable lubricant in the writer's opinion is boroglycerid, to which various antiseptics may be added in small percentage and which is at once fluid, tenacious, freely soluble and definitely lubricating, and even in itself antiseptic. There are various Irish moss lubricating preparations which are also valuable provided they are made up in the fluid state, which is generally not the case. Ambidexterity should be the adjunct of every skilful urologist, otherwise as a rule the operator stands on the right side of the table if right handed and on the left side if left handed, and holds the penis in his opposite hand. The sound is held over the middle line of the body with the shaft parallel with the abdomen or the table, and the point downward. The tip is engaged in the meatus



and slides into the canal up to the shaft of its own weight, carry it, as a rule, nearly to the penoscrotal angle. This step is called "Gravitation," and is shown in Fig. 96. While the handle is elevated to about  $90^\circ$  with the table, the penis is gradually threaded over the instrument, which again of its own weight is allowed to drop downward into the bulb of the urethra. This step is termed "Elevation," and is detailed in Fig. 97. Gentle elevation of the tip, with the handle still vertical, will disengage it from the depth of a large bulb and enter it into the membranous urethra, or the same thing may be accomplished by causing the curve of the instrument to hug the pubic arch as the handle is elevated from the original horizontal to a nearly vertical position. At times support of the instrument over the base of the scrotum and perineum and even guidance into the membranous urethra with the finger in the rectum are necessary. This step is named "Elevation," and is portrayed in Fig. 98. The handle is depressed without force and without encountering resistance until parallel with the table, which brings the curve within the bladder. The shaft, still within the urethra, is now slowly advanced into the bladder for 3 cm. These steps are "Depression," Fig. 99, and "Penetration," Fig. 100. Progress of the sound through its various stages of position through the arch of nearly  $180^\circ$  should be as nearly as possible by its own weight and its freedom within the bladder established by gentle rotation, as shown in Fig. 101, entitled "Rotation." It is at this point that the irrigating principle of the writer's sound is of value because the bladder may be left full and evacuated by withdrawing the obturator and thus entrance into the bladder cavity established and the detail of irrigation established as previously described. The step of "Evacuation" is shown in Fig. 102 and that of "Irrigation" in Fig. 103. Thus are completed the eight steps of the consistent procedure of painless introduction of the sound in the writer's practice. The sound is now left in place for five minutes, withdrawn, the sedative and urinary antiseptic prescribed, the patient directed to rest a few moments against the possibility of hemorrhage, allowed to go home with suitable instructions for as much bodily, urinary and sexual activity as possible.

**Technic with Soft Instruments.**—All the principles previously set down for the posterior urethra as to preparation of the patient, the selection of a flexible dilator of the same or smaller size as that of the bougie-à-boule already passed, again apply. Likewise, the advance in diameter of not more than two sizes from treatment to treatment, the retention for ten minutes and preferably the irrigation of the bladder and urethra by the plan of using a catheter threaded over a dilator which acting like the obturator of the silver catheter in the author's sounds, is withdrawn for the inflow and outflow of the antiseptic fluid are preferred. The attitude of the patient and position of the surgeon are the same, except that the penis is held almost in a straight line parallel with the table. The olive-pointed instrument is the safest and best and should be slightly curved with the hand before engaging

t in the meatus. From this point it is very gently and slowly advanced without resistance, pain or bleeding, smoothly and evenly until it is felt to pass through the sphincter muscles. After due retention the dilator is withdrawn from within the catheter, flushing of the bladder performed, the viscus filled, and then emptied by the patient for cleansing the urethra from end to end.

Soft instruments for strictures of the anterior urethra are used in the same manner as that described for straight steel sounds. The penis is held upright and the bougie is gently passed until it reaches the bulbs. Inasmuch, however, as many anterior strictures are in the bulbar region, it is best to confine this plan to infiltrations anterior to the penoscrotal angle, and to treat all others whether strictly in the anterior or posterior urethra by passing the sound into the bladder.

*Aftertreatment* depends on the form of dilatation employed. In irrigating dilatation cases, employment of flushing of the bladder and urethra as previously noted is all the local measure necessary. If nonirrigating dilatation is practised with either steel or flexible dilators it is well to irrigate the urethra with a small rubber catheter in anterior urethral cases, employing hot boric acid or 1 in 5000 nitrate of silver solution, or to instillate the deep urethra with the Ultzmann or Bangs syringe sounds with a few drops of the same silver nitrate solution in posterior urethral cases. The systemic aftercure is the administration of urinary antiseptics and one sedative pill.

**Dilatation of Tight Strictures.**—Dilatation of tight strictures, which, as stated earlier in this chapter, include those which require a filiform guide, may be performed with either metal or flexible instruments, with preference for the latter when suitable response to them is possible, that is, when the infiltration is not too dense to resist the instrument. In both posterior and anterior urethra all the preliminaries detailed for open and close strictures again apply with added force especially as concerns knowledge of infectiousness and inflammation in the mucosa, administration of urinary antiseptics and local treatment of the urethra either by the irrigating principle, or by the direct flushing or instillation of the mucosa with syringe and catheter. As stated under the subject of close strictures, the calibers below 16 Fr. had best be approached with a filiform guide—a fact from which proceeds the principle that a tight stricture should be opened from the filiform stage to at least 16 Fr. before the guide is abandoned and in very tortuous strictures it is wiser to use the guide even up to 20 Fr. Tight strictures of the anterior urethra may be dilated but rarely remain so, so that internal urethrotomy is to be preferred for them.

**Technic with the Irrigating Tunneler and Grooved Sounds.**—Having passed the filiform guide by the method fully under the objective symptoms of tight stricture, the sound thoroughly sterilized, its obturator freed in its cannula, and lubricated, is threaded over the filiform, which must naturally be sufficiently small to run through the tunnel in the tip. For this reason it is best to have the filiform guides not larger than 4 Fr. in diameter, as the tunnels are 5 Fr. Those which

are 2 feet long are to be preferred, and are passed through the stricture until about four inches project beyond the urethra, making a total of about twelve inches distal to the bladder and twelve inches within the bladder, lying coiled up in reverse for testing the progress of the sound. The sound is held exactly as has been described for the standard instrument and the penis supported in the palm of the hand with three fingers while the index finger and thumb hold the filiform just beyond the curve of the sound already engaged in the urethra. From this position the sound is gently pushed over the filiform with the thumb and index finger holding the latter on guard for any catch or resistance.



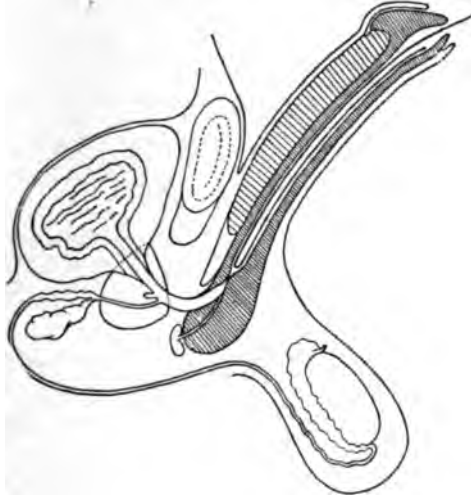
FIG. 106.—Passage of a stricture with filiform guides. The urethra has been conveniently filled with the filiforms. The left hand supports the penis and all the guides except the one which in the right hand is advanced as far as possible. Each filiform is taken in turn in the same way until finally one passes into the bladder. (Original.)

Should such occur progress of the sound is stopped and the filiform taken and either pulled out or pushed in a centimeter or two in order to establish its freedom within the tunnel of the sound. This freedom must be unmistakable, otherwise it is possible to buckle the filiform upon itself and thus pass the sound not through the stricture, but through almost any other point of the canal or to cut the whalebone guide.

The manner in which a filiform may fold on itself should be understood.<sup>1</sup> Fig. 107 illustrates one within the urethra during the effort to pass a deep stricture. As a preliminary caution, before threading a sound on the filiform, careful palpation will ascertain whether the

<sup>1</sup> Pedersen, V. C.: New York Med. Jour., November 20, 1909.

**filiform** has folded on itself and turned distally toward the meatus. **Diagnosis** of the condition is aided by asking whether the patient has



**FIG. 107.**—The anatomical details of this diagram are sufficiently clear and require **no notation**. The stricture is plainly shown just in front of the bulb. The filiform also is **clearly represented** doubled upon itself at the face of the stricture with the shorter element **almost** presenting at the meatus.



**FIG. 108.**—As in Fig. 107, the anatomical details of this diagram are sufficiently clear **to need no notation**. The stricture is plainly shown in front of the bulb. The filiform **also is clearly diagramed** double twice upon itself at the face of the stricture and above the sound. The straight strand of the filiform also appears leading from the urethra and **again** through the stricture into the bladder where the redundancy is coiled within that viscus, thus demonstrating the advantage of using filiforms two feet long.

felt the filiform slide through stricture and sphincter of, and finally coil within the bladder. Doubt may be removed in dealing with ignorant patients by finding two strands of filiform playing upon each other under the finger, or under the eye through the urethroscope.

The manner in which a filiform may be doubled twice upon itself is shown by Fig. 108 with the sound *in situ*, usually by inattention to the binding of the sound on the guide and the displacement of the free end into the urethra as the sound progresses. The diagnosis of this accident is not easy, as the patient can lend no aid and the urethroscope cannot be employed. Careful palpation around the curve of the sound, especially if the instrument is turned from side to side a little, will reach two or more strands instead of one between the stricture and the tip, with none for a short distance where the filiform lies in the tunnel and the groove. The turning of the instrument disengages the various strands, as a rule, and withdrawal soon reveals the whalebone as it turns backward and forward over the sound so that it emerges from the meatus.

Having freed the tunnel and filiform, the sound is now pushed gently forward to the vertical position, then into the membranous urethra and stricture, and finally into the bladder. If the free hand is required to guide the sound by pressure on the perineum or even by rectal palpation, then with each half-centimeter or centimeter of advance, the freedom of the filiform within the tunnel must be tested so that without doubt it is shown that the tip of the instrument is following the guide. Having reached the bladder the same details of using the irrigating attachment as already described are followed. The progress in diameter in tight strictures is usually much slower than in open strictures, on the ground that the pathological process in the former is not only more profound and extensive, but also because the likelihood of complications and accidents is greater. Thus it is best to use the same size of sound two or even three times in succession before adding to the diameter, because the straightening of the tortuosity of these strictures is an element to be reckoned with.

**Technic with Nonirrigating Tunneled and Grooved Sounds.**—If these instruments are chosen, then the urethra should be flushed or instilled with weak silver nitrate solutions, 1 in 5000, with a soft catheter passed to the face of the stricture or an Ultzmann syringe or a Bangs syringe sound engaged at the same point. Manifestly all three procedures reach imperfectly the cavity of the stricture and the proximal mucosa until the caliber has been advanced enough to permit these instruments themselves to pass.

**Technic with Soft Instruments.**—Many tight strictures require the passage of one or two filiform guides side by side at a number of sittings until finally the cone or olive-pointed bougie may be accepted. Excepting with extreme caution it is better to adhere to the olive-pointed bougie or catheter, and the latter with one or two filiform guides inserted as obturators is the instrument of choice as it provides the full degree of irrigation. The general procedure does not vary from that just described for stricture of large caliber.

**Direct Vision Method.**—The Buerger<sup>1</sup> technic for passing a filiform with his direct vision operating urethroscope is detailed under urethroscopy on page 656.

**Continuous Dilatation.**—**Forecare and Preparation** are the same as for gradual dilatation, but the type of case is restricted to tight strictures, because those of other caliber are far more wisely treated by other methods. The instruments are practically only filiform guides, as the use of catheters for this purpose has been practically abandoned because the size of the instrument is such as to provoke foreign body urethritis which may reach marked proportions. The filiforms are passed in the classic manner and retained for twenty-four hours with the excess of length coiled in the bladder at rest where they do no harm if the thin flexible ones are chosen, and excite only a little frequency of urination which may not be due to their presence in the bladder so much as in the stricture zone where reflex influence is excited. One or



FIG. 109.—The author's modification of Banks' whalebone dilator. The instrument is the first, third and fifth from the top and shows its conical form from the filiform to the shaft. The Banks' instrument is the second, fourth and sixth from the top, and shows its flattened portion just before the shaft is reached.

two filiforms thus threaded through a tight stricture will swell sufficiently to open it several numbers. From this point gradual dilatation with tunneled and grooved irrigating sounds or with soft instruments may be proceeded with in the usual manner until the canal is restored to nearly normal condition. The dangers are those of the presence of the filiform guide as foreign body, namely, inflammation around the stricture and along the urethra and the direct mechanical spread of the infection, of which both augment the already-existing conditions. For this reason it is infrequently employed and is not a preferred method but is available only in those cases of old tight stricture without infectiousness and complications in patients who cannot very well be confined to bed for operation. Particularly to be avoided for the foregoing reasons is the use of catheters for continuous dilatation because instruments of any size by contract with the mucosa immediately become offending foreign bodies.

**Aftertreatment** of dilated stricture may be called both immediate and remote, meaning respectively that during active treatment and that

<sup>1</sup> Surg. Gynec. and Obst., March, 1918, No. 3, v, xxvi, 347-350.

after full caliber has been produced. In the immediate aftertreatment during active treatment the patient should have a period of rest in the office and be directed to observe between treatments rest from both active and passive sexual excitement, and rest from urinary disturbance through dietetic indiscretion. Urinary antiseptics are indicated for the first twenty-four hours after dilatation, and antispasmodics, for the relief of vesical spasm, are provided by the free drinking of water, light diet and abstinence from alcohol and sexual intercourse. Mental reassurance of the patient is very necessary as to the facts that there will be for a day or two, after the passage of the sound, some ardor and pain on urination and erection and at times a little discharge, of which all are the unavoidable outcomes of invasion of a mucous membrane. In the remote aftertreatment, the indication is avoidance of relapse of the stricture. The patient should be taught that since the stricture is fundamentally only a cicatrix, it cannot ordinarily be literally removed from the passageway, but its power of obstruction may be corrected by either the stretching or the cutting. He should realize that like all other scars urethral stricture tends with age to dry, or harden, and shrivel or contract, and thus to reclose or reobstruct the urethra. When he understands that this is the law of all scar tissue and therefore the law of stricture, he will regularly report from one to four times a year for observation and the correction of any slight relapse. It is probable that the majority of strictures are perfectly safe only when a sound is passed through them at least once a year.

### Electrolysis of Stricture.

**History.**— One of the earlier English authorities was R. M. Lawrance<sup>1</sup> who, in 1853, said concerning stricture of the urethra: "In this complaint the electrogalvanic current is an efficacious remedy, and very little pain attends the application. After the urethra has been examined with a common plaster bougie, to ascertain the exact position of the stricture, a metallic sound, covered with gum-elastic, and having a conical silver point, should be very gently introduced into the anterior part of the stricture, and then connected with the negative pole of the electrogalvanic machine, the positive pole being placed in the hand or elsewhere. The application should be made daily, using each time a larger instrument, and allowing the current to flow from ten to twenty minutes, according to the feelings of the patient. Eight or ten applications have usually proved sufficient."

Daily applications are, of course, entirely too frequent and much of the early condemnation of this method may have originated in this error.

His later statement, moreover, that electricity is of service in neglected cases with thick, gristly, cartilaginous mass is an error. It is noticed that he correctly emphasized the application of the *negativ*

<sup>1</sup> Application and Effect of Electricity and Galvanism in the Treatment of Cancerous, Nervous, Rheumatic and other Affections.



galvanic pole to the lesion. Later, in 1889, W. H. White<sup>1</sup> who is still looked on as an authority, makes the following misstatement concerning strictures of the urethra and of the Eustachian tube. "These have been treated by passing an appropriate catheter insulated except at its point. This is connected with the anode. The kathode is on some indifferent spot, and a galvanic current of five milliamperes is allowed to flow for five minutes. We have not yet sufficient evidence before us to show whether this treatment is of any value, for while many observers extol it, others say that any good that may result is transitory." It is the kathode or negative and not the anode or positive which should be applied.

In 1888, Brown<sup>2</sup> aims to show conclusively that electricity applied to stricture results in many instances in additional fibrosis, and that it is not only without benefit but often injurious. Taylor<sup>3</sup> in 1904, reiterates this position by stating: "Now, electrolysis has not an electroaffinity for the stricture-tissue, leaving the mucous membrane unaffected, but, on the contrary, acts upon this membrane and destroys it; and whenever the mucous membrane lining in a stricture is destroyed there is a grave probability that the urethra will be obliterated." He then goes on to describe Fort's electrolyser, which is in fact, a galvanocautery of very mild type, and employs a current at least twice as strong as that advised by modern procedures.

The error then of most of these adverse critics was either in using the positive galvanic pole or anode instead of the negative galvanic pole or kathode upon the stricture, or in undue strength, duration and frequency of application, or in haste for penetration. If tissue substance comes away on the surface of the instrument the positive pole has been used. As in dilatation, so in electrolysis, gentleness, patience, and deliberation should be employed and the latter method should not be numbered among the disapproved methods, but rather among the approved procedures for the properly chosen case.

**Selection of Case.**—Galvanism or any other form of electricity will not remove dense scar tissue and much of the adverse criticism of electrical treatment of stricture is founded on error in selection of the case and on improper adaptation of the method. Galvanism is advisable only in open and close strictures which are safely passable without filiform guides, but when tortuosity and dense infiltration are present other methods are preferred. Where dilatation is painful galvanic electrolysis may be substituted with equally good results and without the pain, and where there is a tendency toward spasm and great irritation, the new current of d'Arsonval is advisable. The galvanic negative pole only must be applied to the stricture, as a rule preferably with a silver or zinc electrode and the positive pole, instead of being the usual small sponge contact, an inch or two in diameter, should be

<sup>1</sup> A Text-book on General Therapeutics, p. 292.

<sup>2</sup> Jour. of Cutan. and Genito-urinary Diseases, 1888, vi, 244.

<sup>3</sup> A Practical Treatise on Genito-urinary and Venereal Diseases and Syphilis, 3d ed., p. 217.

nearly a square foot, in area twelve by eight inches, well moistened with warm water and held against the abdomen by a soft bag of gravel so as to insure complete contact of it as the indifferent electrode.

**Instruments and Supplies** must include a reliable source of galvanism or d'Arsonval current, from either battery or wall machine connected with the street current, with suitable controls and a reliable milli-ampèremeter in circuit with the patient and cables, a large pad electrode twelve by eight inches, a soft sandbag, assortment of insulated electrodes in the form of bougies-à-boule, straight and curved sounds, and the like, a urethroscopic outfit of tubes, applicators and solutions, such as tincture of iodine, nitrate of silver, chlorid of zinc in 1, 5, 10, 25 and 50 per cent. watery solution, aromatic sulphuric acid and their type. Local anesthetics are, as a rule, unnecessary but may be included in this list if desired and applied either directly to the part or by injection with a syringe, and none is better than 5 per cent. alypin in boroglyceride or Irish moss jelly, which will serve as lubricant also.

**Technic of Galvanic Electrolysis.**—In type galvanism is bipolar. The patient is placed on a urological table covered with insulating cushions on his back, in position exactly as for dilatation, and the large indifferent positive electrode is moistened with warm water and comfortably fitted to the abdomen under the bag of gravel and then connected with the positive pole of the galvanic apparatus. The negative electrode also connected is passed, down to the face of the stricture if a bougie-à-boule, or just through the stricture if a sound, so that the band is felt to lie over the metal tip. The current is now turned on in strength of from three to five milliamperes, but *no more*, and is allowed to remain on for from three to eight minutes but *no longer*. As a rule, the bougie-à-boule or sound which previously had hesitated to pass will within this interval slip painlessly by the band and may then be withdrawn, and obviously that size of electrode must be selected which might be used as a dilator if the latter were the intended method for the given case. In other words, it should not be expected that an instrument many sizes larger than the known caliber of the stricture may wisely be passed by electrolysis any more than by dilatation. After the instrument has glided through the stricture the current should be turned off before withdrawal, otherwise irritation of the canal may ensue by having the current on as the instrument passes out of the canal.

The repetition of treatment is about the same as that for dilatation determined largely by the behavior of the stricture:—not oftener than once in three, seven or ten days, so that the mucosa will have abundant opportunity to gain by each treatment and not to be irritated by undue frequency and activity of application.

Newman,<sup>1</sup> in 1890, has probably produced the most careful paper on this subject, from which the following essentials are adapted by abbreviation of his "Recapitulation of Rules." A good battery or other

<sup>1</sup> Twenty Years' Retrospect in the Treatment of Urethral Strictures by Electrolysis, with Demonstrations.

stant source of current, a suitable milliampèremeter, a large positive indifferent pole electrode, a selection of the four varieties of negative electrode, preferably with short curves, immersion of the battery in the electrofluid before turning on the current which must begin and end at zero, knowledge of the susceptibility of the patient to the current, weak currents, of from  $2\frac{1}{2}$  to 5 milliampères as extremes and regulated to the work done, long intervals at least a week, applications for from five to twenty minutes, recumbent posture, no anesthetics, no force, no hemorrhage, never two electrodes in succession at one treatment, no pain during treatment, and no treatment during acute and subacute inflammation, no nonconducting lubricants, and by choice bougies three sizes larger than the caliber of the stricture.

**Technic of d'Arsonval Electrolysis.**—This current is a unipolar, and is chosen for strictures accompanied by much pain and spasm in which the element of relaxation becomes important. The patient lies on a d'Arsonval couch, or autocondensation couch, in the dorsal position, and the source of the current is a special high-frequency machine from which the d'Arsonval current may be derived, which is an alternating type. The strength of current is on an average 100 milliampères for strictures in general. The size of the electrode should be as in galvanic electrolysis, not more than two or three sizes of the French scale larger than the caliber of the stricture and, as in the latter electrical treatment, the application is made until yielding appears, but without traumatism, bleeding, pain or cauterization in even the least degree and without the presence of acute or subacute inflammation. The insulation of the electrodes must be very heavy otherwise the high tension-current will short circuit and no good come. It is well to have a set of instruments properly insulated for the d'Arsonval treatment and to employ this same set for the galvanic current as confusion may arise.

Thiosinamine in 10 per cent. solution and in 15 minim doses has been recommended, hypodermatically administered at each visit in association with the electrolysis, or fibrolysin which is salicylate of thiosinamine, may be used in the same manner. Both are regarded as aids in the absorption of newly formed fibrous tissue, but not of hard scar tissue.

**Aftertreatment of Electrolysis of Stricture.**—Immediate further attention is so far as dressing is concerned nothing, but it is well to combine with each application urethroscopic treatment of the zone behind the stricture, exactly as has been recommended in dilatation. That is to say, as soon as the lumen of the stricture is sufficiently open to permit these applications they should be begun and that solution chosen which seems best for the condition displayed. Iodin is a good antiseptic, mercuric and zinc are stimulating, astringent, antiseptic and with judgment mildly caustic, and aromatic sulphuric acid seems particularly helpful to suppurating mucosa. Urinary antiseptics may wisely be administered during the active course, and later during each instrumentation.

**Remote Aftertreatment.**—The final treatment is exactly that for dilatation and consists in the passing of sounds from one to several times each year as insurance against relapse. The end-result is that of dilatation with the added advantage that in painful irritable lesions which might require incision and bed care this more conservative plan may be followed with the gain of painlessness and safety and of the added destruction of organisms within the tissue by the current itself throughout the treatment.

## • OPERATIVE TREATMENT OF STRICTURE.

### APPROVED PROCEDURES.

Approved procedures have already been stated as dilating urethrotomy, internal urethrotomy, combined external and internal urethrotomy and excision, while the disapproved operations have been both mentioned and dismissed with the basis of their condemnation on page 363. The general application of operative treatment compared with nonoperative measures has also already been sufficiently detailed on page 363.

### Internal Urethrotomy.

**Varieties.**—There are two classes of operation: those of the meatus, called meatotomy, and those of the anterior and posterior urethra, called internal urethrotomy, without distinction as to the point of the canal involved.

#### Meatotomy.

**Instruments and Supplies** include a hyperdermatic syringe, cocain or other local anesthetic solution, blunt-point, straight-blade bistoury, bougies-à-boule, even numbers 24-34 F., and straight sounds, even sizes 24 to 34 Fr., cotton, gauze, scissors and probe. The anesthesia is local and produced either by injecting weak cocain solution into the site of the incision, or by inserting a wick of gauze or cotton with the probe into the meatus for an inch, and then impregnating this with the anesthetic solution and allowing it to remain five or ten minutes. The incision is in the midline along the floor in the normal meatus, and along the roof also when there is anatomical defect in the form of reduplication of the canal, which may be a dimple, a blind pouch or a canal or a diaphragm and must be explored by the probe for its limit before operation. The depth of the incision enlarges the meatus up to 28 to 34 Fr. according to the diameter of the urethra in the proximal canal, determined with the bougie-à-boule after the preliminary opening of the stricture. It should be about two sizes larger than the final diameter required because contraction always occurs to about this limit and it should never be extended to involve the floor of the urethra through the skin, as one occasionally sees, constituting a veritable postoperative balanic hypospadias. The extent of the incision along

ethra must relieve the constriction at the meatus and at the al limit of the fossa navicularis whose diameter usually dupli- hat of the meatus.

sounds are of value in this determination, because sometimes a -à-boule will seem to show a constriction where none exists to und and it is well to use both to recognize a narrowing back of sa navicularis before proceeding with definite extension of the 1 through it.

dressing is conveniently a small strip of the selvage edge of free from ravel, tucked into the depth of the wound with the und kept in place by cutting it off quite close to the glans and by



110.—Supplies for meatotomy. From left to right are shown local anesthetic, blunt-point, straight-blade bistoury, metal bougie-à-boule, straight sound, and gauze swabs, forceps, probe, selvage-edge gauze drain and scissors.

ing the patient to seize the meatus from below while urinating. ol iodid or bismuth subgallate powder may be sprinkled upon l and gauze before this dressing, a loose external gauze dressing its any ooze of blood from soiling the underclothing and after a our's rest for cessation of hemorrhage the patient goes home. : **aftertreatment** is comprised of renewals of the gauze, the first of which usually comes away on the third day and of the passing nds up to a number or two less than the size of the original cut ler to prevent the wound from collapsing and healing, and to l it to cover in from the sides with epithelium. The end result is a of nearly uniform diameter from the penoscrotal juncture for-

ward, so that the treatment of the deeper canal may proceed with convenience and thoroughness. The patient should be informed that his stream will be ribbonlike and possibly spattering, through the free outlet.

#### **Internal Urethrotomy.**

**Synonym and Definition.**—Internal incision of the urethra.

**Instruments and Supplies** should include those for meatotomy, as this is almost always necessary, and add the following: one cone point urethral syringe, 5 per cent. alypin or other local anesthetic in boro-glycerid or Irish moss jelly, lubricants of the same substances, ball sounds and standard sounds even sizes up to 32 Fr., Otis urethrotome with straight and curved tunneled points, curved and straight Maisonneuve urethrotome with the three knives of the author cutting to 22, 26 and 30 Fr. diameter, filiform guides, urethroscope with lamp and knife, assortment of catheters, bladder syringe 150 c.c. capacity, weak silver nitrate or other antiseptic solutions and applicators, cardboard splints, adhesive plaster, sterile cotton and gauze dressings and gauze bandages.

**Type of Case.**—The operation is applicable for close strictures which admit the Otis urethrotome (16 Fr. diameter) or the staff of the Maisonneuve urethrotome (7 Fr. diameter). Simple threadlike transverse strictures may be located with and divided through the urethroscope tube.

**Preparation of Patient and Preliminaries** are the same as for any other urethral operation, and the anesthesia may be local in moderate cases with one or two strictures, or general in marked cases requiring deep extensive incision of one or more dense strictures. A preliminary meatotomy is in most cases advisable in order to permit proper calibration of the urethra during the procedure. The site of internal urethrotomy is always dorsal in the midline, in depth dividing all the bands of the stricture, and in extent interesting the infiltrated zones distal and proximal to the contraction, so as to relieve tendency to relapse from these annexa. The localization and calibration of the strictures is done with the ball sound, beginning with the largest, which will pass the distal urethra easily with or without the meatotomy, and which will thus lodge on the face of the first stricture. The penis is now allowed to resume semiflaccid state and the distance of this stricture from the meatus is laid off on the measure and recorded. Each stricture proximal to the first is measured in the same manner and all the distances are recorded on the shaft of the Otis urethrotome by placing an elastic band for each stricture at the required points, starting with the full exposure of the knife and allowing a half-inch in addition for division of the proximal annexa. The more modern urethrotomes have inch- and half-inch subdivisions on the shaft for this purpose, while the Maisonneuve shaft requires neither elastic nor scale because the division of the stricture by this method is from before backward and thus strictly localized to the cicatrix.

**Varieties.**—Anterior and posterior internal urethrotomy by the methods of Otis and Maisonneuve and the urethroscope are recognized. Dilating urethrotomy is a variety of the standard operation in which the element of tension or dilation of the mucosa is largely exaggerated until divulsion is present. This introduces all the objections of rapid dilatation or divulsion of stricture and for this reason this step is no longer approved. With its omission dilating urethrotomy is synony-



**FIG. 111.**—Supplies for internal urethrotomy and urethroscopic internal urethrotomy. From left to right are shown for internal urethrotomy syringe and anesthetic with catheter for filling the bladder and urethra, author's model of curved and straight Maisonneuve urethrotome with knife, Otis urethrotome with knife, metal bougie-à-boule, straight sound, author's irrigating curved sound, whalebone filiform guide, and Janet-Frank syringe. For urethroscopic internal urethrotomy, the Chetwood urethroscope and lamp and long, sharp-pointed knife are to the left of the Janet-Frank syringe.

mous with the method involved in the use of the Otis urethrotome, to be described below, which aims to divide all the bands of the stricture.

**Anterior Internal Urethrotomy.**—**Otis's Internal Urethrotomy.**—*Type of Case.*—The Otis Internal urethrotomy is available for anterior and posterior cases with preference for the former, as complications so often occur with the posterior strictures. The technic of passing the shaft for anterior urethrotomy is exactly that of the straight sound and the



groove of the knife is held strictly in the middle line of the penis which is allowed to assume the semiflaccid position as soon as the point of the distal stricture is reached. The dilating jaw is now opened until the dial indicates about two sizes larger than that shown by the large

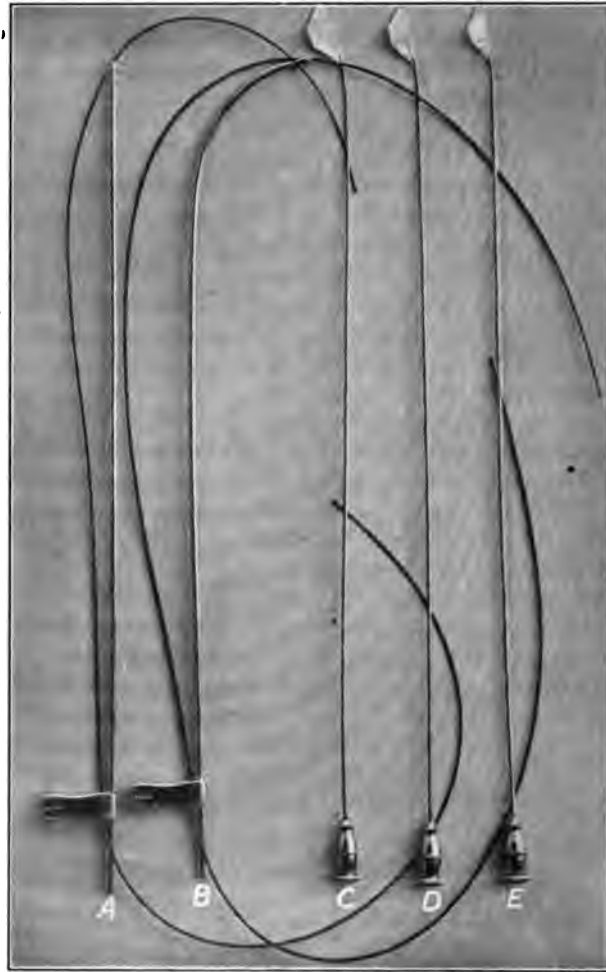


FIG. 112.—Author's Maisonneuve instrument. Straight and curved staffs (A-E) with olive tunneled tips carrying 24 inch whalebone filiform guides, which pass backward through a canal in a long-lever handle, which being opposite the groove protects the fingers from accidental wounds. C, D, E, are 30, 26 and 24 French knives.

bougie-à-boule accepted by the distal urethra which usually placed under full tension all the stricture bands, which are then divided by pulling the knife forward from an inch to an inch and a half and retiring it to its socket. The second and subsequent strictures are divided in exactly the same procedure, removing each elastic band

with the progress made until finally all have been divided. Sounds are now passed to establish the full lumen of the urethra into the bladder and, as in meatotomy, about two sizes larger than the end result desired in allowance for contracture. Bougies-à-boule are also used to detect undivided bands which would indicate measurement of their position and division by the same method.

**Maisonneuve's Internal Urethrotomy.**—*Type of Case.*—The Maisonneuve internal urethrotomy is applicable for anterior and posterior strictures with the same warning of danger in deep-seated lesions. The filiform guide must be passed and the shaft of the instrument threaded over this by the technic described for the dilatation of stricture with tunneled and grooved sounds. The modern instrument has the tunnel opposite the groove of the knife so that as far as possible the filiform will not be cut. With the penis on the stretch and the groove in the middle line, the knife is entered and slid very slowly down the urethra so as not to fold and cut the mucosa before the stricture is encountered, which is divided by steady pushing of the blade through the mass. Each stricture is treated in the same manner as reached until all have been divided. The author adopts three blades, 22, 26 and 30 Fr. on the basis that the average membranous urethra is 27 Fr., and is advisedly not artificially increased in size. If anterior urethrotomy alone is desired the shaft of the instrument is held vertical to the table and the knife passed until the base of the curve is reached, which in this position will ordinarily be in the deep urethra but not the bladder. If a posterior urethrotomy is also required, the blade is advanced until stopped by the groove in the instrument which is usually just outside the sphincter of the bladder which should in no case be divided. Having incised all the strictures with the proper size of blade selected in accordance with the measurements with the bougie-à-boule, the knife is slowly withdrawn and followed by the shaft and filiform. "Sawing back and forth" with the knife is prohibited by respect for the mucosa, but is sometimes seen in the hands of general surgeons. The passing of sounds and bougies-à-boule is the next step exactly as in the Otis method.

**Posterior Internal Urethrotomy.**—*Limitations and Dangers.*—Posterior internal urethrotomy is undertaken with caution on account of the frequency of infection and complications in these lesions, the difficulty of drainage, and the facility and rapidity of absorption.

The presence of the filiform guide is essential and the Maisonneuve is preferable to the Otis method because its shaft duplicates the form of the standard sound and is more manageable than that of the Otis instrument in the deep urethra, which has the difficulties of all straight instruments in this region. In all severe strictures of the posterior urethra therefore only the external urethrotomy is indicated and advisable.

**Urethroscopic Internal Urethrotomy.**—*Selection of Case* assigns this method only to threadlike strictures of the anterior urethra more or less transversely placed.

**Instruments and Supplies** add to those of the foregoing procedures only a set of open-end urethroscopes of the Chetwood type, lamps, source of illumination and its control, and an assortment of urethroscopic knives and applicators, if the incision method is adopted, and the Buerger operation urethrocystoscope, high-frequency cable, and high-frequency transformer and switchboard if the fulguration method is preferred. The preparation of the patient is that for any standard urethral procedure and the anesthesia is almost invariably local.

**Technic by Incision** places the patient in the moderate lithotomy posture and the urethroscope is passed in the standard manner down to the face of the stricture whose caliber has previously been carefully measured, using a tube if possible which will not pass the band so that the latter is stretched across the lumen. The knife is now taken and the band divided by transfixion, from base to free border, and then sounds are passed in order to open this little cut to the full diameter of the canal. The disadvantages are uncertainty as to division of all the fibers of both stricture and its annexa and consequent likelihood of relapse.

**Technic by High-frequency Current of Oudin.**—This involves the same preliminaries but includes passage of the operation urethrocystoscope through the stricture and withdrawal until the band crosses the field near the point of the cable, which is advanced until it touches the obstruction near the base. The current is now turned on with a spark gap of  $\frac{1}{8}$  to  $\frac{1}{4}$  inch, and the switch half-open on the controller and applied until the mucous membrane is thoroughly blanched of all circulation. The point of application is now moved outward until from base to border the band is cauterized throughout its depth. Sounds are now passed in order to spread open the cauterized zone thus produced in the stricture and thereby to remove all obstruction. Small bands may be wholly removed by this procedure. The disadvantages of this method are likelihood of cauterizing beyond the base of the stricture into the urethral wall and producing a more extensive infiltration than the stricture itself. With caution and judgment it is an almost painless highly efficient procedure and not followed by hemorrhage.

**Aftertreatment of Internal Urethrotomy.**—Immediate methods must comprise flushing of the urethra with the soft catheter and syringe and 1 in 2000 silver nitrate solutions at 105 to 110° F. which may also be used in the bladder if it has been entered, as a means of asepsis and hemostasis. The dressing is with cardboard splints and adhesive plaster with pressure sufficient to stop bleeding but insufficient to obstruct urination or circulation, as either or both will induce congestion, edema and secondary hemorrhage. The meatotomy, if performed, is dressed as just described. The remote aftertreatment is the matter of passing sounds exactly as noted under dilatation and throughout the aftertreatment urinary antiseptics had best be administered for a brief period in association with each instrumentation, and especially while in bed just after the operation.

The immediate aftertreatment of both the incision and fulguration

methods with the urethroscope is about the same as that for meatotomy and internal urethrotomy, and consists of the passing of sounds in order to make the divided mucosa close in from the sides with epithelium as a new surface, leaving the band divided into two little tabs which do not obstruct and usually atrophy as the end result in many cases. The same rule for the remote aftertreatment of all stricture cases applies and requires the passing of sounds every few months as preventive of relapse.

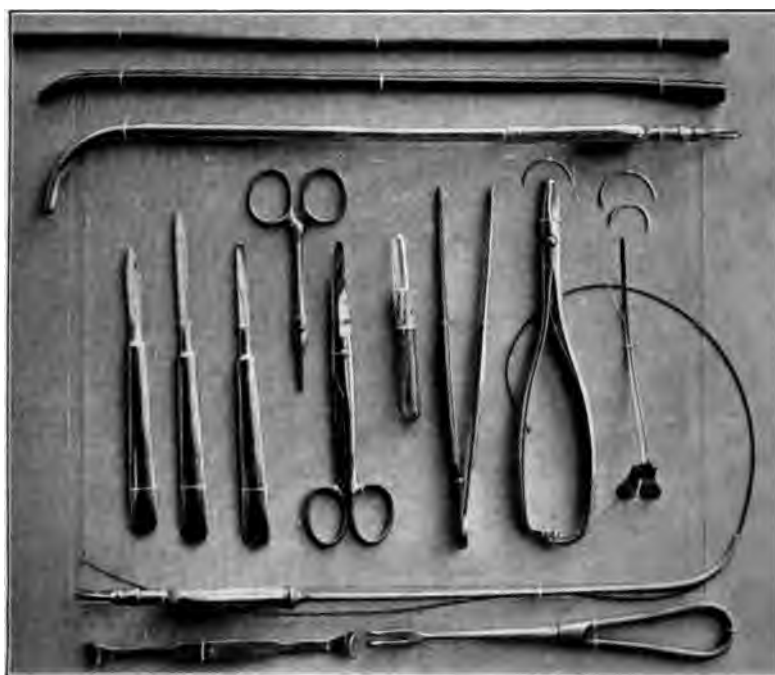


FIG. 113.—Instruments for external urethrotomy with a guide. From above downward at the top are the standard perineal tube and elbow catheter for drainage and irrigation; the author's standard double taper irrigating sound with obturator *in situ*; and at the bottom the author's standard tunneled and grooved sound with obturator in the canal and with a long whalebone filiform guide through the tunnel and a sharp point and a blunt point small retractor. From left to right in the middle of the figure are scalpel, sharp and blunt point straight blade bistouries, artery clamp, scissors curved on the flat, ligature, long forceps, needle holder, assorted needles with a suture in one needle and a curve grooved director.

### External Urethrotomy.

**Synonyms.**—Perineal section, perineal cystotomy, combined internal and external urethrotomy and urethrotomy with drainage.

**Selection of Case.**—In addition to the principles in the early part of this chapter for the choice of the various treatments of stricture the following details apply for this operation. External urethrotomy is available for stricture impassable or passable only to filiform, or so

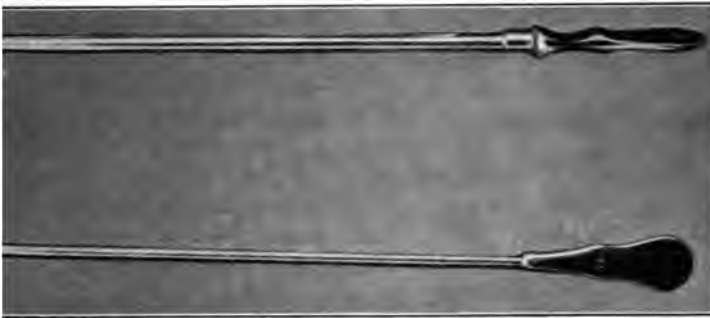
by spasm at the neck of the bladder, or the bottle segment may be folded or twisted by the patient's limbs or bed-clothing. The glass connecting link or any part of the tube may be clogged with urinary sediment and pus. In prevention thick-walled tubes carefully protected from pressure and cleansed at least every day are to be employed and watched at regular intervals.

With oozing absent and drainage of urine established, instruction of the patient requires his comprehension that the tube behaves like a foreign body, slightly irritating the bladder and exciting the desire to urinate, both duly decreased by quiet in bed and control of vesical activity which otherwise first increases distress and hemorrhage and then decreases drainage of urine. Feeling of distention of the bladder is to be reported by the patient, verified by percussion above the symphysis by the surgeon, and relieved by adjustment and irrigation of the tube just described. Sedatives in the form of a small dose of morphin by the needle, or an opium suppository in the rectum with its stretched sphincter, are often required during the first hour or two.

The renewal of the original dressing is not necessary for several days unless it becomes contaminated with decomposed urine, when it should be taken down as far as the gauze drains and thereafter built up and supported in the original manner. The perineal tube is left in place for from three to seven days with irrigation of the bladder at least daily for the longer residence and the administration of suitable urinary antiseptics. Gauze packing for bleeding should remain unchanged until quite loose in the wound, as disturbance will reëxcite hemorrhage, otherwise the gauze should be refreshed every day. If an internal urethrotomy has been done in the anterior urethra or if discharge appears at the meatus, irrigation of the canal with a hand syringe from meatus to wound should be undertaken and if it is desirable to leave the perineal tube in for nearly a week, straight anterior urethral sounds may be passed at least once down to the tube on or about the fifth day. When the drainage tube and gauze packing are removed, the anterior urethra and the wound should be washed with weak silver nitrate solution (1 in 5000 to 1 in 2000), and the bladder also, if there has been cystitis. The open wound is then treated on surgical principles with gauze drains saturated in balsam of Peru, or castor oil and balsam of Peru in equal parts, or red wash consisting of 2 per cent. zinc sulphate and tincture of lavender in water. The writer's standard or Béniqué irrigating sound one or two sizes smaller than the largest used at the operation should be passed from meatus to bladder when the tube is removed and thereafter at regular intervals slowly increasing, such as five, seven, ten, fourteen and thirty days. A perineal pad of sterile gauze and a good T-binder are employed while the wound in the perineum is closing, through which the patient will urinate in decreasing quantities until final closure, while the urethra becomes more and more the normal and then the final outlet. The patient should sit as woman does to urinate until the wound is closed, to avoid accident to his clothing, or hold a pus basin between his thighs into which he

are received. If there has been great granulation tissue in the stricture, as shown by the deep field, then instillations of silver nitrate solution with the Bangs syringe sound, using the size of nozzle as would be employed for the irrigating sound, be adopted about once in five days in frequency and from 1 in 1000 silver nitrate solution in strength.

**Aftertreatment** is the same as that necessary in any other kind of stricture and has been described under the dilatation of the urethra. The most important details are attention to the chronic inflammation underlying the stricture, remaining after the obstruction has been divided, and leading to a relapse rapidly unless treated or cured, and the passage of irrigating sounds at several intervals each year, determined by the tendency of the stricture to recur, which is various from case to case. The end result of external urethrotomy is uniformly good if there are no complications or false



14.—Pedersen modification of the Wheelhouse guide, showing at the bottom the tip of the instrument for the reception of the knife blade and at the top the prominence of the tip with the shaft and the tunnel and groove of the

es, and if the fibrosis has been fully divided along both the floor and roof of the canal and if suitable aftercare, both immediate and long-term, are applied. In subjects of compromised kidneys, such as chronic nephritis or pyelonephritis, the operation is one of severity and danger with which the family of the patient must be fully acquainted.

**Internal Urethrotomy without a Guide.—Varieties.**—The recognized varieties are the Wheelhouse operation, suprapubic cystotomy with catheter sounding of the urethra and Sinclair's method. Both the methods of Wheelhouse and Sinclair in certain circumstances might be considered as external urethrotomy with a guide, inasmuch as the same filiform guide may in such cases be employed.

**Indication of Case** respects those strictures suitable for external urethrotomy in which only the filiform guide is accepted or no guide at all.

**Internal Urethrotomy of Wheelhouse.**—**Instruments and Supplies** are the same as those of external urethrotomy with a guide and include the

Wheelhouse staff, which is a straight instrument, grooved throughout its shaft, tunneled for a half-inch at its tip, which has a distinct projection at right angles to the shaft at the front surface of the tip. The diameter of the tip in the standard instrument including this projection is usually 24 Fr., which is taken on the ground that it is sufficiently small to enter practically every urethra and large enough to make the projection very prominent within the urethra at the face of the stricture. The author has modified this instrument by cutting a groove deeply into the projection so that the knife readily engages in it in the middle line of the urethra, instead of slipping to either side.

**Technic.**—The guide is passed down to the face of the stricture directly, if no filiform has been passed, or over it if one is *in situ*. The grooved lip of the tip is now turned backward against the floor of the urethra where it may be distinctly felt as two rather sharp points with the groove between them and at or near the distal face of the obstruction. While the guide is held in the midline of the body, with the penis and scrotum stretched upon it exactly as in external urethrotomy with a guide, the finger is placed on the prominence of the tip in the perineum, and the knife is penetrated into the urethra between the two points of the tip. This small incision is lengthened forward about a half inch so that traction sutures may be passed into both lips through skin and mucosa, and then extended backward over the stricture area up to the anal verge exactly as in the standard operation. The Wheelhouse guide is now removed and with the aid of a probe or director passed along the filiform guide or of traction on the latter itself the canal is followed and opened along the floor an eighth-inch or so at a time until the entire obstruction is opened. Then the roof of the stricture is divided from end to end and the rest of the operation, including the immediate and remote aftertreatments of each case, duplicates that of external urethrotomy with a guide, described in the preceding paragraphs.

If the passage of a filiform guide has not been possible, then the preliminary injection of a dye such as indigo-carmin may be employed to penetrate the cavity of the stricture. With gentleness and deliberation this is almost always possible and is of great service in opening the canal accurately after the face of the stricture has been exposed with the aid of the Wheelhouse guide. With the stricture canal thus laid open the other steps of the technic are the same as those just described.

**External Urethrotomy with Suprapubic Cystotomy and Retrograde Sounding.**—**Selection of Case.**—An impassable stricture with failure to find the canal in the perineal field of an ordinary external urethrotomy renders this operation necessary, but less advisable than the method of Sinclair.

**Instruments and Supplies** embrace those of external urethrotomy with a guide and include two sharp retractors and two blunt retractors for entrance into the bladder and the necessary needle-holder needles, catgut, silk, etc., for suture of the bladder and skin after the operation.



**Technic.**—After the standard external urethrotomy has failed and as part of the same sitting and after the usual preliminaries, through a median abdominal incision, two or three inches long, the superficial field of skin and underlying aponeuroses, muscles and fasciæ are exposed down to the deep field of the bladder wall crossed by the peritoneum in the upper part of the wound. The serosa is pushed back and the bladder opened as near its highest point as possible between two stout traction stitches through and through its walls by an incision just long enough to permit inspection of its contents and the passage of the sound in the retrograde direction to the proximal surface of the stricture. A filiform guide or small woven sound may sometimes be passed through and through the stricture and then the remainder of the operation becomes an external uréthrotomy with a guide. Otherwise a sound is passed down the urethra to the face of the stricture and held in the usual position as nearly as possible in line with the retrograde sound from the bladder and then the urethra is opened step by step in the usual manner along the floor and then the roof between the tips of the two instruments, often with the aid of injected indigo-carminé to mark the canal. After the fibrosis has been fully divided and drainage of the bladder carefully established with the perineal upper wound in the bladder is fully closed with two or three layers of Lembert or mattress sutures, from which a small cigarette drain passes through the lower angle of the abdominal wound closed in the standard method and protected with the usual sterile dressing. The abdominal drain is removed in twenty-four hours, the abdominal wound managed along accepted lines, while the perineal field and drainage receive the attention already noted. Thus after the closure of the suprapubic cystotomy the immediate and remote aftertreatment become that of external urethrotomy with drainage of the bladder. The objection to this operation is the opening of the bladder through the abdominal wall with its added suffering and danger. The method of Sinclair accomplishes the same purpose with the danger practically removed and with no suffering.

**External Urethrotomy with Retrourethral Cystoscopic Guide.**—

**Selection of Case.**—This method was devised by Sinclair,<sup>1</sup> of New York, for impassable strictures as means of avoiding the difficulties and uncertainties of external urethrotomy without a guide and the dangers of suprapubic cystotomy and retrograde sounding of the urethra for the same class of case.

**Instruments and Supplies** comprise the following: A three inch, 15 Fr. trocar and cannula; a five inch, 12 Fr. observation telescope, spiral and 12 Fr. Herzfeld eustachian catheter and whalebone filiform guides. To these may be added the usual supplies for urethral cases, especially the source and control of light for the telescope.

**Technic.**—Technic involves instruction of the patient as preparation not to pass urine for several hours before the operation (which is

<sup>1</sup> New York Med. Jour., April 4, 1914.

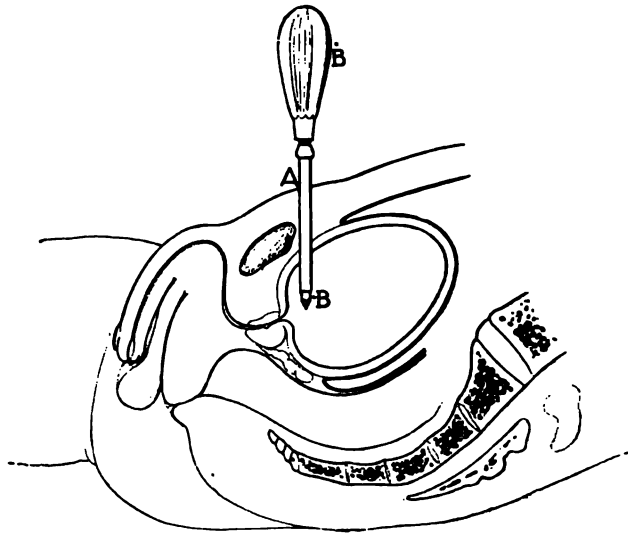


FIG. 115.—Cannula *A* and trocar *B* introduced into the distended bladder. (Sinc

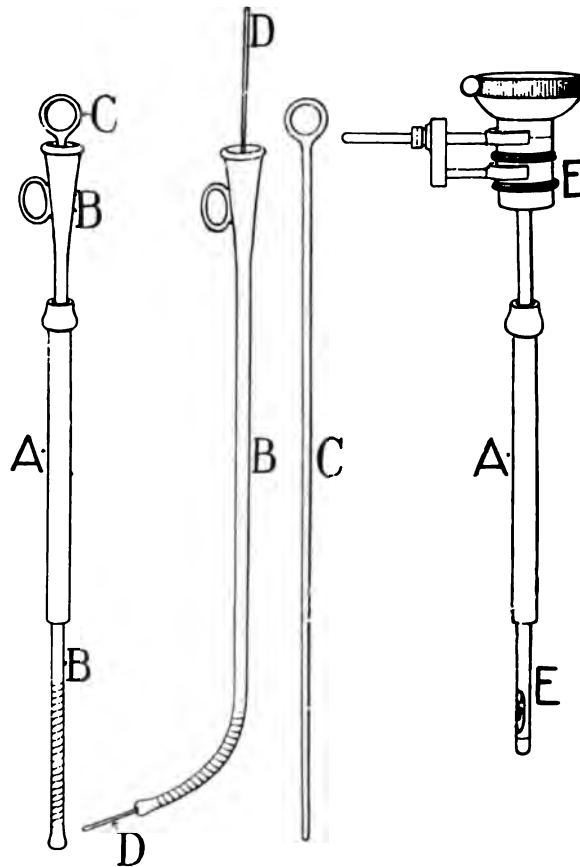


FIG. 116.—Cystoscope *E* passed through the cannula *A* for bladder inspection. shown are the automatic, flexible spiral curved guide *B* with the obturator *C* *in situ*; with the obturator removed and replaced by a filiform bougie *D* after the guide entered the posterior urethra. (Sinclair.)

commonly the unavoidable situation for most of these sufferers) and the usual cleansing of the field. The anesthesia is local or general and the posture moderate Trendelenburg. The trocar and cannula are now plunged into the bladder from a point one inch above the symphysis pubis directed downward and backward to the general region of the

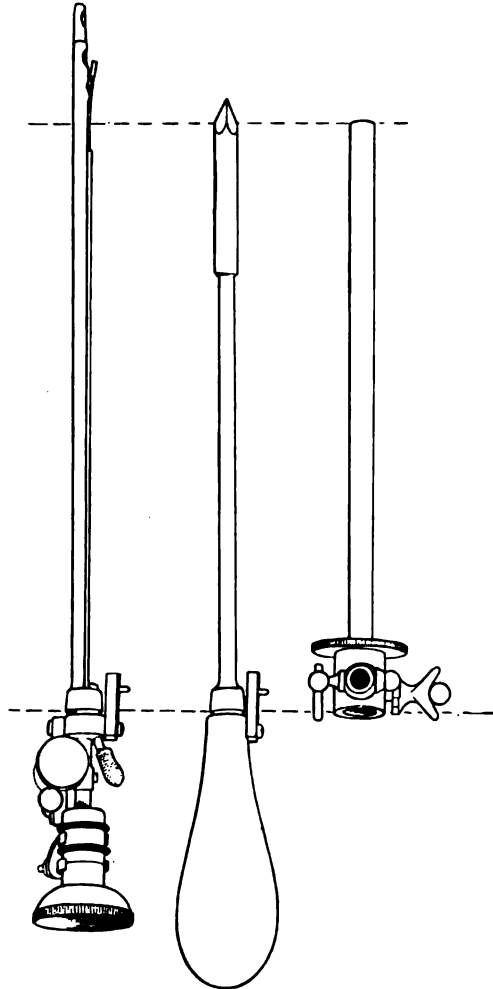


FIG. 117.—Combination trocar, cannula cystoscope, the cannula acting as a sheath for the catheterizing telescope, through which a woven, flexible metal guide may be fed passively into the prostatic, membranous and anterior urethra. (Sinclair.)

ical outlet. If the bladder does not percuss well above the symphysis pubis, it should be filled with the hand syringe by fitting the nozzle tightly into the meatus and slowly forcing the fluid into the urethrus, which may commonly be done in cases permeable to urine but impassable to the filiform, especially if the mucosa is decongested with

the aid of adrenalin and cocain.. If the bladder cannot be thus artificially distended, it is necessary to wait until full of urine before proceeding. After entrance into the bladder the trocar is removed, the bladder evacuated and then thoroughly irrigated with a catheter through the cannula, using a 12 Fr. in order to permit the return flow around it. After the latter is thoroughly clean the bladder is comfortably filled and the observation telescope after testing the light is introduced or not according to least expense.

General inspection of the bladder follows and localization of the internal urethral orifice, which is as closely approached as possible by manipulation of the end of the cannula and cystoscope. The latter is now removed and while the cannula is held in position accurately, the Herzfeld eustachian catheter is introduced with the spiral curved end presenting anteriorly, straightened as it passes through the tube, but resuming its curve as it approaches the vesical outlet. The handle of the eustachian catheter is depressed downward and backward in the midline of the body toward the spinal column which carries its flexible tip along the urethra to the proximal surface of the stricture exactly as depression of the handle of a urethral sound carried its tip from the anterior into the posterior urethra and finally into the bladder. Rectal examination confirms the position of the instrument. The patient is now placed in a lithotomy position and the eustachian catheter as a retrograde guide exposed in the canal in the usual manner. A whalebone filiform guide may be threaded through the cannula and thence through the stricture in the reverse direction in cases which have refused the guide from meatus to bladder, possibly because most strictures with this behavior are acutely obstructed at the anterior rather than the posterior surface. The eustachian catheter is now removed through the cannula, and the latter is then withdrawn, a stream of saline or boric solution being forced through during its removal. The suprapubic puncture does no harm and heals kindly, aided by the usual perineal drainage tube, which relieves all strain in the bladder wound and leakage into the perivesical planes. This skin wound is simply covered by a piece of sterilized gauze.

The foregoing clever technic may be carried out with standard instruments of the required sizes, but for the sake of greater accuracy and convenience Sinclair has made a modification of this combination of instruments. It consists of an oval shaped, No. 18 French trocar and cannula, the cannula being five and one-half inches long, and acting as the sheath for the cystoscopic telescope. The technic for its introduction into the bladder is the same as for the smaller and original instrument mentioned above; a No. 5 Fr. flexible metal guide may be passed through this instrument and, under direct vision, fed into the posterior, and even through the anterior urethra, thus acting as an efficient guide for external urethrotomy, when it is impossible to pass a guide from the urethra into the bladder. As is so frequently the case, standard instruments are for the average operator who has acquired skill in bladder and urethral work more serviceable than special modi-

tions and the use of the former has the advantage of decreased cost and maintenance.

**Aftertreatment.**—Immediate and remote aftertreatments are the same as those already detailed for other forms of urethrotomy. The little wound in the skin and the bladder made by the trochar usually heals by primary intention or with little delay.

### Resection of the Urethra.

**Selection of Case.**—A tortuous stricture without undue length may be resected and the ends of the canal brought together. The preliminaries and supplies are the same as for external urethrotomy.

**Technic.**—The urethra is exposed well beyond the stricture through the skin and underlying tissue as the superficial field, and then the stricture is removed from end to end, including the roof, as the deep field. If the length of canal lost is not great, the ends of the divided urethra are united with great care with fine needle and catgut, first along the roof and then the sides, but the floor of the canal is left open for drainage and healing by secondary intention. The skin incision is also not closed but left open for the freest possible drainage down to and around the suture line, so that if infection occurs it will remain superficial and not penetrating. In order to immobilize and rest the urethra a perineal drainage tube is employed through an opening in the canal proximal to the suture line and sufficiently removed from it not to interfere in any way with the healing. If a large part of the canal has been removed it may be necessary to free the distal stump from its bed between the corpora cavernosa in order to obtain the necessary relaxation of the part and freedom from tension.

**Aftertreatment.**—The immediate and remote measures are as in external urethrotomy with special emphasis on the passing of sounds after the suture line has closed in order to stimulate the establishment of a proper lumen of the canal.

### ACCIDENTS OF TREATMENT OF STRICTURE.

**Varieties.**—The accidents of treatment of stricture are of two classes. These are (a) hemorrhage and false passage, which are those produced directly by the instrumentation without close connection with the infectious element and (b) urethral infection, cystitis, prostatitis, epididymitis and urethritis, which are those caused by the infectious element with definite relation to the instrumentation.

**Urethral Hemorrhage.**—**Significance.**—During urethral examination and instrumentation hemorrhage of ordinary degree may occur and is without importance except as indicating either undue size or force of the penetration or exuberant granulations. More copious hemorrhage is apt to mean false passage with the sounds or the division of large bloodvessels during an internal or external operation.

**Etiology.**—Hemorrhage may occur during dilatation or operation just stated. It appears during dilatation largely in accordance with

oratory examination reveals the blood in moderate or large quantities in addition to the previous signs of the stricture, such as pus, foliated epithelium, mucus and organisms. The treatment usually results in easy relief in strictly urethral hemorrhage, in the sense that the operation has not divulsed or incised into the corpora cavernosa. This distinguishes it from the essential hemorrhage so often seen from the kidney, bladder, prostate and vesicles and not infrequently very difficult to control.

**Treatment.**—Minute bleeding during treatment of stricture is almost inevitable, but prevention of higher degree of hemorrhage rests on gentleness, soft instruments, slow progress from smaller to larger diameters and rest of the urethra for from five to ten days between treatments in the average case. The curative measures in mild cases after dilatation are hot urethral irrigation with 2 to 4 per cent. boric acid water or 1 in 10,000 potassium permanganate solution and the like, which are both antiseptic and astringent. Rest on the operating table, office couch or bed at home with the penis held firmly in the palm of the hand exactly as the small boy holds a cut finger, for many minutes, and as often as the bleeding may resume is efficient. Ice or heat locally to the perineum, abstinence from urination for several hours and gentleness in the evacuation of the bladder are all of value. Severe hemorrhage after internal urethrotomy or dilatation often requires firm, even pressure with a pad of gauze placed along the whole urethra, which is carried up and laid along the abdomen. Occasionally an indwelling catheter may be used for twenty-four to forty-eight hours as a means of counterpressure and of rest of the urethra by drainage of the bladder. After external urethrotomy mild cases will usually cease after hot water is applied to the wound by douche and sponges or by simple packing. The marked cases, however, require a pyramid of gauze assembled in the so-called tent dressing about the drainage tube and forced into the wound in all directions and held in place with a well-applied T-bandage or diaper, which should include a large dressing, covering the entire genitals. Of course, the depth of the wound should first be searched for bleeding points, which may be stitched or seized in artery clamps and tied. Styptics by local application or irrigation are available in all cases.

**False Passage.—Definition.**—A false passage is an opening from the urethra into the surrounding planes of cellular tissue, so that urine may escape into them, or a passage opening from the urethra at one point passing along it and either again opening into the urethra or into the bladder, so that urine may more or less pass through it. A false passage may, therefore, either be a blind pocket admitting the tip of an instrument and urine or a complete and more or less patent canal.

**Varieties.**—The passage may be superficial and short or deep and long, thus involving only the mucosa or the surrounding corpus spongiosum and cellular planes, and thus concerning either the urethra alone at one or two points or even the bladder and prostate in its

course from the urethra to the bladder. The passage may be received and without complications or old and with complications, especially extravasation of urine and abscess.

**Etiology.**—Changes in the mucosa about a fibrous stricture permitting easy laceration, and the pockets about a diaphragmatic stricture essential to its transverse position and form are the predisposing causes. Lack of skill and force in the passing of any instrument is regularly the exciting cause. All rigid instruments, whether bougies-à-boule, sounds, or catheters, or soft instruments with metal stilets, and all pointed instruments whether flexible or rigid, are specially likely to cause false passage. The flexible should, therefore, be preferred to the rigid and the olive-point to the cone-point variety.

**Pathology.**—A stricture usually of tight and complicated variety is present, whose pathological features need no comment beyond that given on page 336. The essence of the process is a pocket or a passage instrumentally produced as a laceration passing from the face of the stricture along the mucosa, or into the corpus spongiosum for a variable distance and there ending, or again emerging into the urethra at any point behind the stricture or even into the bladder itself. The tissues involved are, therefore, according to its extent, the urethral mucosa, the corpus spongiosum, the cellular planes of the penis, scrotum, perineum and rectovesical spaces, prostate and bladder, all according to circumstances. The temporary lesions are those of the simple wound in the slight cases while the permanent lesions partake of the features of at first sinus and later scar of extensive limits. The complicating lesions are those of extravasated urine in the older severe cases and of cystitis when the bladder has been entered and infected from the general inflammatory process. All these features have been described as to pathology, each in its own place on pages 336 to 343. The location of the passage is commonly in or about the posterior urethra, where the majority of severe strictures exist, but occasionally it may be in the anterior urethra.

**Symptoms.**—The symptoms may be local and systemic, subjective and objective. The subjective local symptoms are tearing sensation, pain, hemorrhage and sometimes inability to urinate from reflex inhibition or temporary obstruction; and the systemic signs are syncope, alarm and often the onset of urinary infection or so-called fever. If extravasation of urine and abscess occur all the symptoms thereof previously described prevail. The objective local symptoms arise from the behavior of the instrument after the application of force. The mucosa suddenly yields and the tip changes its normal direction from the axis of the urethra commonly to one or the other side, while the handle is deflected to the opposite side and rotated slightly with the beak. If the bladder has not been penetrated, rotation of the instrument is not possible except at the cost of more violence tearing and pain. With the tip in the bladder rotation is possible, but with an abnormal direction of the shaft and handle of the instrument which is pathognomonic. Hemorrhage ensues around the shaft of the



ument and is usually copious. Palpation at first along the distal portion of the urethra up to the general region of the stricture and then proximal to it, will show the shaft of the instrument in the normal passage up to the stricture and thereafter outside it and traceable between the crura penis into the perineum, beneath the pubic arch to the prostate or the rectovesical spaces and even bladder in exceptional cases. Rectal examination is therefore essential in these cases. If extravasation and abscess have developed, all their objective features previously noted will be added to those of the stricture. Urethroscopy, especially with irrigation, will reveal the wound in recent cases and the sinus or pocket in old cases and should not be omitted.

The termination of mild blind cases is commonly prompt recovery without complications, but deep blind passages or complete canals with both openings in the urethra or one in the bladder are apt to induce complications and never get well without operation. The significance of false passage is, therefore, great if located in the posterior urethra with such involvement and complication of the bladder and perirectal, perivesical and periurethral structures.

**Diagnosis.**—The patient describes a long or severe, continuous or relapsing history of symptoms of stricture, followed by rough or hasty efforts to pass steel instruments, especially those with small shafts and more or less sharp points. The subjective symptoms are those of pain during the instrumentation, followed by a sense of laceration and bleeding. With these are urinary disturbance or even obstruction with fear, fainting and fever. The objective symptoms on palpation may be the nodulation of the stricture surrounded by the edema of the false passage and the boggy of the extravasated urine and the subcutaneous infiltration of blood and pus. On instrumentation the sound will deviate from the normal axis of the urethra and cannot be rotated. A catheter does not evacuate the bladder. Bleeding follows any such instrumentation as a rule. On rectal examination the instrument may be traced in its course along the urethra and into any of its cellular or glandular annexa. Urine, blood and pus may be expressed by the examining finger. The urethroscope is very serviceable in locating the distal opening of the false passage, and also the proximal opening of those false passages which leave the urethra in front of the stricture and enter it behind the stricture. The laboratory examination adds but little more than perhaps blood and shreds of tissue in the urine in recent cases. In older cases the shreds and pus are more abundant. In the treatment by open operation the positive diagnosis is in some cases alone reached.

**Treatment.**—Gentleness, patience, soft instruments, full diagnosis of all the characters of the stricture are the preventive measures, and there is today less excuse than ever before for this accident. Rest in bed for a few days at least and total absence from urethral invasion of any character for several weeks are the first curative measures in old cases, while in severe cases the patient should remain in bed for said two or three weeks under light diet and urinary antiseptics.

Urethral irrigation should also not be done. The surgical cure of the stricture is the first step in any marked case, as restoration of the normal caliber of the urethra usually puts the false passage at rest and promotes healing. Perineal section is the operation of choice because it drains the bladder and posterior urethra and absolutely quiets the canal in front of the drain-hole, and often permits free opening into the wound of the false passage from end to end whose course has been indicated by methylene blue or other dye and thus causes it to heal completely from the bottom. The operation should always be done with a guide which may commonly be passed with all the aids detailed under the dilatation treatment of tight stricture. After hot styptic irrigation of the urethra a filiform, alone or after filling the urethra with them or through the urethrosopic tube displaying the face of the stricture or alongside an instrument passed into and filling the false passage, may commonly be made to pass through the lumen of the stricture. If this fails the method of Sinclair,<sup>1</sup> consisting of suprapubic puncture of the bladder with a trocar and cannula, location of the vesical outlet with a cystoscopic telescope and lamp and the retrograde passage of an instrument or filiform down to the proximal face or through the lumen of the stricture and then proceeding with the usual steps of perineal section. Or the older operation of suprapubic cystotomy with a guide inserted from within the bladder may be done. Or without a guide and only with the aid of injected dye stuffs, perineal section may be undertaken. The *aftertreatment* of such cases must respect both the false passage and the stricture, so that if possible the former may be made to heal before the urethra is allowed to close.

**Complications.**—The complications of false passage already set down as urinary infection, extravasation of urine, abscess, sepsis, sinus and fistula, have the appropriate treatment already described for each respectively on pages 409 to 412.

**Urinary Infection.**—**Synonyms.**—Urinary sepsis, urinary poisoning, urinary fever, urethral fever, urine fever, urethral chill, urine chill, catheter fever—a list which confesses indefinite knowledge in the past, as to the exact condition when fever was regarded as a disease instead of the sign of reaction by the body to infection. The term urinary infection is probably the most definite.

**Definition.**—A nervous or septic state, or both combined, acutely following urethral intervention or at times chronically associated with long-standing urogenital disease.

**Varieties.**—Nervous, embracing chiefly shock and traumatic, including chiefly septic absorption or combined, in which traumatism and infection are added to nervous debility.

**Etiology.**—In each form the predisposing factor is either a naturally deficient nervous system, which reacts profoundly to any surgical incident or an acquired nervous weakness from septic foci, and in the traumatic or infective form profound disease in the kidneys, bladder,

<sup>1</sup> Loc. cit.

prostate and urethra, causing urinary decomposition, infection and a tendency to chronic absorption, or to an active acute absorption through even a minute wound. The exciting elements are, therefore, the various pyogenic microorganisms, especially the *Bacillus coli communis*, the streptococcus and the staphylococcus entering through an abrasion or laceration in the urethra directly or indirectly through reflex inhibition of diseased kidneys after instrumentation of the urethra. Probably the unhealthy granulating urethra proximal to a stricture is a very common portal of invasion of microorganisms already resident therein or of such as are in the urine as it passes over it. The decomposing urine of chronic cystitis especially in the retention of enlarged prostate and of chronic pyelonephritis is undoubtedly the most fertile source of the organisms.

**Pathology.**—There is no true pathogenesis in nervous urinary infection as the phenomena are reflex, even when the nervous debility is secondary to chronic septic absorption. There is a focus of absorption in acute traumatic septic urinary infection usually passive about a stricture, in the kidneys, bladder, or urine itself which requires only a very little disturbance to render it active by direct entrance into the bloodstream. The urine in chronic septic urinary infection is profoundly altered chiefly by the *Bacillus coli*, the streptococcus and the staphylococcus, the kidneys extensively invaded and the bladder the seat of severe cystitis with the prostate hypertrophied below and in front of it. From any or all these niduses, singly or associatedly, little or no exciting factor will induce an acute sepsis grafted on the chronic form already existing. The pathology of each of these underlying conditions has already been described under its own subject.

**Symptoms.**—Symptoms vary with the two varieties, neuropathic and septic. In the nervous type the patient is timid, anemic and of low resistance. A simple examination, a meatotomy or the passing of a sound even without the presence of a stricture but more especially the slight pain of dilating a stricture is followed by partial or total fainting, a chill rarely with, usually without, temperature and malaise for a few hours at the most. Very rarely is there any inhibition or stimulation of the kidney function and it is doubtful whether this manifestation should logically be classed under the heading of urinary infection, excepting from respect for tradition in this condition. In a patient whose nervous constitution has been undermined by persistent septic absorption all these nervous phenomena may be added to and increase the conditions really proceeding from the sepsis itself.

In the traumatic, septic type the cases are mild, severe and chronic and show the following symptoms: In the mild cases the patient has for a day or two a chill followed by a fever of occasionally high range, considerable depression and at times decrease in the amount of urine, while his skin may compensate by sweating. For part of a day or more these patients are quite sick, usually in bed, and then fully recover. In the severe cases so-called acute urinary infection—the chill is intense, often prolonged and repeated and precedes or follows the onset of the

fever, which may reach 106° F. or even more, with partial or total suppression of urine for a few or many hours. Uremic symptoms as mild or active delirium, profound changes in the pulse and strength may supervene so that all these patients are rather dangerously sick. The termination in the majority is recovery unless the kidneys are much involved, but the patients are prostrated for a day or two after the crisis. In the minority of such victims death may follow from acute or chronic uremia and sepsis in a few days and occasionally in a few hours from the combined total suppression of urine and its toxic absorption and the low resistance of a body already damaged.

The foregoing is often called acute urinary infection and arises from seemingly trivial causes in patients having a favorable urological basis, to distinguish it from chronic urinary infection which rests on such persistent septic lesions as pyelonephritis, cystitis, prostatitis, especially with residual urine, stricture with urethritis and the various complications of all these conditions, which favor urinary decomposition, infection and absorption. From such foci absorption is almost always more or less chronic and continuous, against which the system scarcely holds its own, so that a very little irritation brings on an acute condition. In the chronic and slowly progressing cases the patient nearly always has more or less fever, anemia, ill health and depression, while in acute exacerbations of this chronic state almost any symptom complex may arise, after severe, trivial or unknown injury or surgical intervention. The termination of these low-grade cases is in chronic or acute uremia or lethal urinary infection, of which the latter two may follow any of the signs just described.

The combined, or neuroseptic, type is probably not a distinct entity except in so far as in some individuals sepsis reacts most upon the nervous system so that all the neurotic symptoms are exaggerated and induced by trivial causes and then followed by the more important symptomatology as just described.

**Diagnosis.**—The three forms vary slightly. In the history the nervous type admits susceptibility to fainting and other phenomena in slight circumstances, and the traumatic or infective form embraces lesions of the kidneys, bladder, prostate and urethra as foci of absorption. The subjective symptoms are the shock and temporary disturbance in the nervous type but the slow or rapid, moderate or severe infection in the traumatic or infectious form, and the objective signs show no physical basis for the condition in the nervous cases except the obviously defective nervous system. The traumatic septic patients may show almost any lesion of the annexa of the urethra, the urethra itself or the urinary organs as the point of onset as well as all the signs of sepsis. The laboratory investigation verifies the foregoing objective findings by establishing profound nephritis, for example, and demonstrates the infecting organisms in some cases.

Chemical hematology, as discussed in Chapter XV on page 863, is the latest progress recognizing the influence of lesions like severe stricture on the body. No operation on severe and complicated

cture should be undertaken without a chemical hematology for toxic substances retained in the blood.

The treatment only adds the final proof in combating the infection by medicinal and serological methods or by direct surgical attack on the infecting focus.

**Treatment.**—In urinary infection prevention is important and closely related with bacteriology, urinalysis and renal functional tests in every severe case of stricture. The bacteriology has been dealt with sufficiently under the subject of diagnosis of stricture on page 353 and needs no addition. Urinalysis will reveal rather accurately the source of epithelium and pus from urethra, bladder or kidneys and the nature of albumin and the number and kind of casts. It will, therefore, furnish a reasonable forecast of the kidney function which may be further elucidated by the phenolsulphonephthalein, indigo-carmin, urea and other tests, all, of course, in cases having permeable strictures through which urination is still possible. If the stricture is closed one must proceed immediately, with the choice favoring drainage operations on account of the ignorance of underlying conditions. Urinary antisepsis may be promoted by the administration of any of the following, salol grains 5, sodium salicylate grains 5, formin grains 5, urotropin grains 5, and sodium benzoate grains 5, in a glassful of water every two to four hours. The benzoate of soda may be combined with the formaldehyde preparations with special activity toward the *Bacillus coli communis*. Urethral antisepsis may be aided by irrigation of the urethra before and after invasion, when it may be secured through any but a tight stricture. It is here that the tunneled and grooved irrigating sounds of the writer are available and his suggestion that woven catheters with flexible bougies as obturators be employed where soft instruments are necessary. Through these the bladder may be filled with appropriate antiseptics, itself irrigated if advisable and in turn flush the urethra from end to end in Nature's own method with the contained fluid. Gentleness of instrumentation and infrequency of treatment so that the defective urogenital tract may fully recover between each treatment are of great importance as preventives. Thus dilatation should not be repeated oftener than every five to seven days if the case is at all severe. Sedatives after the visit, such as a pill made up of morphin sulphate, grains  $\frac{1}{8}$  to  $\frac{1}{4}$ , tincture of aconite, minims 1 to 3, and quinin grains 3 to 5, will often prevent the nervous reaction. Bodily quiet is always of aid and rest is necessary for the chronic cases.

The curative measures of urinary infection actually present are, for the nervous cases, rest in bed, a sedative for the fear and nervousness, stimulant for the prostration if present, followed by a urinary antiseptic and possibly diuretic and cathartic in the more marked cases. Urethral irrigation is a precaution. In the acute septic cases all these measures must be actively combined and sometimes continued for several days. Normal salt solution is a potent stimulant of the flagging bowels, applied to the colon and rectum by the drip method of Murphy,<sup>1</sup>

<sup>1</sup> Jour. Amer. Med. Assn., 1909, lii, 1248.

now so familiar, or by injection into a vein or beneath the skin unless the blood-pressure is already very high. Hot packs and other familiar preventives of uremia are important. In the chronic variety the damage of the upper urinary organs is usually so profound that prevention becomes the turning point and unless successful subsequent treatment is often useless. Its principles are those just laid down in that the condition to be met is usually acute symptoms supervening on the chronic state. In the combined neuroseptic type the nervous signs are simply the expression of the chronic pus absorption and may be reached indirectly, if at all, by relieving the underlying depreciation and then treating the nervousness as it arises.

**Urethritis, Epididymitis, Prostatitis and Cystitis.**—**Occurrence.**—In the course of treatment of stricture any of these accidents may occur singly or all may be variously associated in one clinical picture as a common process.

**Etiology.**—The direct excitation of dormant infection already present, or the direct transference of bacteria from one point of the urogenital tract to another, is the usual source of these accidents. The direct excitation of inflammation is by sounds too large, too violently used or applied for unduly prolonged period. These procedures would tend to provoke catarrhal inflammation in a normal canal and will certainly do so in a diseased mucosa, and if the organisms of suppuration, notably the gonococcus, are present, the field is ripe for a fresh outbreak of localized or extending acute disease. The direct transference of microorganisms occurs by the passage of an instrument over a dormant focus, itself becoming infected by the pressure of pus from glands and pockets upon its surface and then as it passes forward along the canal dragging this material to new points perhaps of moderate traumatism where it engrafts itself, thus also excites a localized or extending acute disease, or an infected instrument not properly sterilized may do the harm.

*Urethritis* is favored by the character of the normal mucosa and the condition of the diseased points for an exacerbation of local or extended distribution. It harbors the organisms in its mucous follicles and possesses little resistance to the development and penetration of the gonococcus and other pyogenic bacteria. It will thus readily suffer a localized outbreak immediately around the stricture where it is profoundly altered, or an extension from this point of onset or a direct infection from pus-bearing instruments proximal to the stricture, where, as a rule, the congestion and traumatism of strain during passage of the urine have reduced its resistance.

*Epididymitis* arises in two different manners. The mouths of the vasa deferentia in the colliculus may be invaded directly by infection of an exacerbation of urethritis as just described. Or through disease of the entire urethra proximal to the stricture, previously fully detailed their outlets are patulous and will readily receive infectious material carried into the deep urethra by sounds or other instruments. It is probable that traumatism of the more or less diseased colliculus itse

a potent element in these cases. The clinical features of epididymitis have been described under that heading on page 146 and will not be repeated.

*Prostatitis* has been dealt with in its clinical varieties as follicular and parenchymatous involvement on page 116, and needs notice only as to its origin during the treatment of stricture. The back pressure from the obstruction traumatizes the posterior urethra and congestion and catarrh of the entire region follow, to which very readily the infection is added. In all severe strictures rectal examination reveals a boggy, indolent enlargement of the prostate constituting congestion of more or less chronic type. The irritation and traumatism of instruments readily activate this process into an acute catarrhal or suppurative invasion, follicular or parenchymatous in its distribution.

*Cystitis* arises either as a direct result of instrumentation or of infectious activity. The instrumental causes are: (1) direct trauma of the neck of the bladder by large instruments in simple dilatation; (2) irritation or ulceration of the mucosa by pressure in prolonged or continuous dilatation; (3) exacerbation of previous chronic urethrocystitis, trigonitis or cystitis, through even incidental instrumental contact. The bacterial or infectious causes are: (1) direct extension into the bladder of a fresh urethritis instrumentally excited as just described in the preceding paragraph on urethritis; (2) direct infection with instrument, pus-bearing or germ-bearing, either through having been improperly sterilized before use or through having passed over an infectious zone in the urethra; (3) organisms may reach the circulation of the blood through portals opened from active foci by instruments, reach the bladder in the ordinary course of their excretion from the system by the kidneys and set up cystitis in a viscus rendered atonic and nonresistant by the strain, congestion and irritation of the back-pressure from severe stricture. It should in general be remembered that any of the ordinary organisms inhabiting a diseased urethra may be at the bottom of such infections—a fact which only again emphasizes the importance of knowing the bacterial conditions of all severe strictures. Culture is, therefore, the step which will reveal the virulence of the germs found, and should always be taken. All the clinical manifestations of cystitis are described in Chapter II, on Complications of Acute Urethritis on page 166.

**Diagnosis.**—These four accidents of the treatment of stricture vary in their diagnostic details. In the history there must be absence of these lesions followed by their more or less prompt occurrence after the treatment of the stricture. The stricture itself is commonly of the more active type with slight discharge or shreds constantly present and irritability under even slight debauches and not uncommonly a positive bacteriology for the gonococcus and its allies. Subjective and objective symptoms are those distinctive of these four lesions as fully detailed under each in Chapters I and IV, on Acute and Chronic Urethritis and Complications of Acute and Chronic Urethritis, respectively, in Chapters II and V. The seven-glass test of



the author is available for the prostatitis and the cystitis in cases involving any doubt and in distinguishing them from simple anterior or posterior urethritis and spermatoecystitis. The urethroscope and the cystoscope are valuable in the later periods when the urethral element is in abeyance. The limitation of these instrumental means of diagnosis is that their unavoidable irritation of an already vulnerable and nonresistant mucosa sometimes stimulates another outbreak. They should therefore not be undertaken without gentle irrigation of the urethra at least immediately after their employment. The laboratory adds the organisms responsible for the infections and shows the characteristic epithelia and other products from the bladder, prostate and testes. The treatment in its course will clear up all doubtful points.

**Treatment.**—Treatment of these accidents is chiefly preventive management, consisting in the full diagnosis of the character and infectiousness of the stricture and then in protection of the system against local invasion by the administration of urinary antiseptics and protection of the canal by irrigation with mild antiseptics before and after treatment in suspected cases. The irrigating sounds of the author are of extreme value in this therapeutic field in that the irrigation includes the bladder and the entire urethra in Nature's own process and without the added invasion of passing a catheter after a sound. The curative treatment has already been described under the separate heading of each accident—urethritis, epididymitis, prostatitis and cystitis in the chapters named on page 417.

#### COMPLICATIONS AND SEQUELS OF STRICTURE.

**Significance.**—Stricture is in itself a complication of gonococcal infection and may superinduce complications of its own course or augment those already existing, from which it arose. In the former group are to be classed the urinary complications in the bladder, ureters and kidneys, often of the ascending and less frequently of the hematogenous type, and also to be included are the sexual sequels especially in the prostate and less commonly in the testicles. In the latter group are the urethral lesions, especially the folliculitis and the chronic changes in the proximal urethra. These facts lend double importance to the cure of the stricture and the relief of such sequels.

**Varieties.**—Complications and sequels of stricture concern the urethra, the sexual organs about it and the urinary organs above it and the general system. Each of these complications is fully discussed as it arises independently of stricture and therefore details may be omitted here. The urethral complications are urethritis, due to stasis and decomposition of urine and the infection, muscular hypertrophy followed by atrophy arising from strain to overcome the obstruction, false passages and fistulae caused by muscular or instrumental rupture, extravasation, cellulitis or abscess. The sexual sequels are the same as those in any other posterior urethritis which is always present in severe

**stricture, seminal vesiculitis, funiculitis, epididymitis and epididymo-orchitis.** This group of complications is often of the relapsing type during stricture. The urinary complications mark progress of the infection through and above the sphincter of the bladder and are cystitis often followed by hypertrophy, atrophy and sacculation of its muscular coat through strain, ascending ureteritis and pyelitis either by direct extension after dilatation or by lymphatic absorption and the later developments of pyelonephritis and pyonephrosis which may also be



**FIG. 118.**—Dilatation of the ureter and of the pelvis of the kidney secondary to a chronic retention of urine produced by a close stricture of the urethra. (Legueu.<sup>1</sup>)

by direct progress from the mucosa of the renal pelvis or by indirect infection through the lymphstream or bloodstream. The systemic sequels are either high grade or low grade, usually fatal sepsis and uremia—acute or chronic.

**Etiology.**—The existence of the stricture itself with the surrounding effects on the urethra and its glands and on the other sexual and urinary organs through their mucosæ is the predisposing cause. Any factor which tends to provoke extension of the disease from the stricture and

<sup>1</sup> *Traité Chirurgical d'Urologie*, 1910.

its annexa is the exciting cause. Such a factor may be systemic and diathetic as already shown in urethritis itself or may be local through sexual or other debauch and instrumental interference or improper treatment of the stricture.

**Pathology.**—All cases are necessarily of the secondary type, being dependent on the antecedent stricture and its pathogenesis. The processes are in their essence and stages identical with those already described for the same lesions primary in the various organs stated under varieties or secondary in them as complications of other lesions of gonococcal urethritis. These complications of stricture therefore involve the same tissues, and have the same temporary, permanent and associated lesions. In the same way the bacteriology in nowise is different.

**Symptoms.**—All the clinical features remain the same in these complications as have been already described for them elsewhere—under its own heading. There is no need therefore to discuss the subjective and objective, local and systemic symptoms of the onset, establishment or termination. They are simply engrafted on the symptoms of the antecedent stricture.

**Diagnosis.**—All the complications and sequels of stricture are very fully detailed under each complication as it arises independently of stricture and will not be fully reviewed here, but the classification of these sequels into urethral, sexual, urinary and systemic must be borne in mind. The urethral complications are largely recognized by the urethroscope and the seven-glass test of the author as to the chronic inflammation, hypertrophy and atrophy of the urethra and as to the internal openings of false passages and fistulæ. Probes and filiform guides may be passed through these often from within when impossible without the canal for demonstration of extent and course. External openings are usually obvious to sight and touch. Dye-stuffs injected through external openings may be seen to appear in the field of the examining instrument. Rectal, perineal and penile palpation are good guides. The sexual sequels are already fully diagnosticated and differentiated under seminal vesiculitis, funiculitis, epididymitis and epididymo-orchitis under each subject. An otherwise unexplained relapsing form of any of these complications at once suggests stricture as its basis although the narrowing may not be tight. Prostatic enlargement acts in the same manner, especially with reference to the testicle and vas. The urinary complications, which include inflammation, hypertrophy, atrophy and sacculation of the bladder, ascending ureteritis, pyelitis, pyelonephritis and pyonephrosis, are proved by the history of onset in the course of severe stricture, by the subjective symptoms and objective findings on urinalysis—physical, chemical, microscopic and bacteriological—followed by suitable exploration of the bladder and kidneys with the cystoscope and ureteral catheters as soon as the urethral obstruction permits. Further diagnosis and differential diagnosis are given under each lesion as already stated. The systemic sequels of uremia and sepsis must be deduced from the subjectiv

and objective analysis of the case as it has progressed from the urethra to the urinary system and thence into the body at large. Modern examination of the blood for bacteria, urea and other products of disease is of great service.

**Differential Diagnosis.**—Recognition of the complications and sequels of stricture is set forth under each foregoing complication as it arises during anterior and posterior gonococcal acute and chronic urethritis, both as concerns the distinction of the lesions from others in the same group and also their identity from other conditions of the urogenital system or other systems. The reader is, therefore, referred to paragraphs on these subjects in Chapters II and V.

**Treatment.**—Treatment is after this enumeration obviously referred to the paragraphs on curative measures for each of the complications. The prevention is all-important and is chiefly embodied in bacteriologic diagnosis of each stricture and in the proper gentleness and graduation of treatment of the stricture itself and in suitable immediate aftercare of the urethra to prevent extension or absorption. As already stated, active bacteriology in a stricture marks it as one of danger requiring special attention. Abortion is futile, as in these complications arising in other circumstances.

**Retention of Urine.**—Retention of urine is a symptom of stricture which may be of the acute type arising suddenly or of the relapsing form recurring more or less frequently in attacks themselves acute, although the condition may be chronic. The features of acute and relapsing retention have already been fully described for these conditions as they arise as complications of acute and chronic urethritis, in Chapters II and V on the Complications of Acute and Chronic Urethritis on pages 197 and 331.

**Extravasation of Urine.**—**Synonyms.**—Urinary infiltration and rupture of the urethra with infiltration or extravasation of urine are the other terms commonly applied to this condition. Rupture of the urethra without extravasation, especially of traumatic origin, may occur although the reverse is the rule.

**Varieties.**—Varieties distinguish as to site, extravasation anterior to, within and posterior to the triangular ligament; in other words, respectively penile, membranous and prostatic extravasation, inasmuch as the rupture is in these portions of the urethra. Each has its own field of extension of the urine within the subcutaneous tissues.

**Etiology.**—Etiology embraces predisposing and exciting factors, which are only local. The predisposing elements are the pathogenesis in the urethra proximal to the stricture as described on page 340. The exciting cause is rupture of the urethra after sudden closure of a tight stricture by edema, through the effort to force urination in the majority of cases, while in the minority of cases careless instrumentation upon a tight annular stricture of narrow extent tears through the urethra around it, making a false passage and extravasation. Pressure of the complications of stricture such as abscess of Cowper's glands may lead to extravasation.

**Pathology.**—The laceration of the urethra followed by the appearance and extension and decomposition of the urine in the tissues is the essence of the process, dependent of all the factors in the pathogenesis of stricture in the proximal urethra previously detailed. To this foundation is added the rupture by muscular strain or the laceration by instruments followed by the leakage of urine at each effort to evacuate the bladder. The edematous stricture added to the antecedent tight stricture before the accident is followed by more edema



FIG. 119.—Extravasation of urine of the dissecting type, probably originating anterior to the triangular ligament and thus extending chiefly forward into the perineum and scrotum and down the inside of the thighs guided by the fascia attached to the rami of the pubis and ischium. The urine probably broke through the barriers of fascia on the left side and traveled backward over the buttock as far as the general region of the hip-joint. (Watson and Cunningham.)

from the inflammation caused by the urine, which still further tends to prevent resolution. If surgical intervention now occurs, the process ceases in these temporary lesions; but commonly the second stage with permanent lesions supervenes, consisting in the stage of decomposition of urine in the tissues with infection, abscess and sinus, and followed by systemic absorption, often serious and even of fatal degree. The complicating lesions of this condition are chiefly the reflex results

<sup>1</sup> Watson and Cunningham: *Genito-urinary Diseases*, 1908, vol. i.

in the kidneys due to the altered hydraulics in the lower urinary tract and to the septicemia. Operation done at this period often leaves behind the scars and fibroses of the abscesses, which may be very extensive and deforming. The extension of urine in the subcutaneous planes may be moderate or extreme and the direction of travel of the urine depends on the anatomy of the planes of fascia of the perineum and the site of rupture within them, as stated below.

*Fascia of the perineum*<sup>1</sup> are two: superficial and deep. The superficial fascia has the following extent and attachments. In the rectal half of the perineum the subcutaneous fat passes into the ischio-rectal fossa. The pyramidal cavity is limited by the levator ani muscle and the obturator fascia. In the penoscrotal half of the perineum under the subcutaneous fat is a definite layer of fascia prolonging the dartos backward and constituting the superficial perineal fascia or fascia of Colles. This layer is attached bilaterally to the rami of the pubis and ischium along the borders as far as the tuberosity of the ischium, and posteriorly between the ischial tuberosity and the central point of the perineum it folds over and behind the posterior border of the transversus perineal muscle, and unites with the deep perineal fascia as detailed below. An imperfectly developed mesial septum passes from the upper or deep surface of the superficial fascia upward toward the urethra, and forward into the scrotum. Thus air forced beneath the superficial perineal fascia in one side, will pass into and balloon the scrotum on that side and later penetrate to the opposite side also, through defects in the median septum. Additional force will carry it upward over the abdomen as far laterally as Poupart's ligament, where the superficial fascia is attached. The air, however, will not pass backward toward the rectal half of the perineum nor downward over the thighs. Urine extravasated into the same plane of fascia will follow the same course through retention by the **attachments of the superficial fascia of the perineum.**

The deep perineal fascia (subpubic fascia, triangular ligament of the urethra) closes the pubic arch on the upper aspect of the penile crura and urethral bulb. Its two layers are thin, firm, fibrous and surround several structures. The superficial or interior layer passes to the perineal central point in the midplane of the body, and then to the rami of the pubis and ischium laterally and to the superficial fascia of the perineum along the transversus perinei muscle, posteriorly into the angle between the crura of the penis and the rami of the pubis bulb bone anteriorly. The upper or deep layer separates along the urethra into right and left lateral halves, close to the apex of the prostate, continues into its capsule and thence into the rectovesical expanse of the pelvic fascia. Laterally they are united with the obturator layer of the pelvic fascia. Thus this layer of fascia covers the anterior surface of the levator ani muscle which is interposed between it and the rectovesical fascia and is connected with the anal fascia which passes backward over the surface of the levator ani muscle.

<sup>1</sup> Quain's Anatomy, 1892, Pt. II, vol. ii.



Urine extravasated into this layer of fascia will, if between the two layers of the triangular ligament, be retained there until it suppurates through or, if posterior to the deep layer, fill the ischiorectal space and pass thence downward upon the thighs and buttocks. From the foregoing anatomical details it will be seen that extravasated urine must travel in the following direction according to the relation between the point of rupture (penile, membranous or prostatic) and the planes of fascia.

*Penile rupture* has the point of exit anterior to the triangular ligament, and shows its extravasation either in the scrotum and groins or in the penis alone. (1) In the former case the rupture is bulbar in site and the urine is confined within the dartos of the scrotum and the superficial perineal fascia, within which it travels upward toward one or both groins.

The superficial fascia of the thigh is attached to Poupart's ligament so as to prevent the urine from reaching the anterior, inner and outer surfaces of the thigh, as a rule, but it may travel from the attachment of the penis and scrotum along the groin and upward over the abdominal wall in rare cases.

After it passes the partial median septum of this fascia, it may then travel down the penis from a scrotal invasion or become bilateral from a unilateral onset. (2) In the latter case the rupture is in the pendulous urethra outside the dartos and the superficial perineal fascia and therefore tends to pass along the cellular planes about the corpus spongiosum urethræ.

*Membranous rupture* has the site of escape of urine between the layers of the triangular ligament and remains pocketed in this situation unless secondary abscess permits it to escape through either anterior or posterior layer or both into the scrotum or perirectal spaces, respectively.

*Prostatic rupture* has the focal point posterior to the triangular ligament and commonly in the anterior part of the prostatic urethra, and is confined by the deep layer of the triangular ligament and extensions of fascia to the bones and muscles of the ischiorectal fossæ. Its median septum may make the accumulation at first unilateral and later bilateral or the lesion may be initially bilateral. The tendency of this accumulation is not only to invade the ischiorectal fossæ but also to extend backward over the buttocks and downward along the inner surface of the thighs.

**Symptoms.**—Symptoms add the features of rupture, extravasation, decomposition, infection and sepsis to those of a tight stricture followed by stricture by edema or sudden closure from other causes, and include subjective and objective local and systemic elements. The subjective local signs are the pain of the rupture followed by the greater and progressing pain of the extravasation, which is repeated and augmented by every act of urination unless relief is prompt and efficient. If delayed into the stage of decomposition and infection all the local suffering of extending cellulitis and abscess appear. The subjective



systemic signs usually are at the moment of rupture in the nature of urethral chill, subnormal, then supernormal temperature, with wide excursions and all the signs of sepsis in the circulatory, respiratory, nervous and urinary system—rapid, hard or thready pulse, excited respiration, nervous irritability or depression, chills and fever, and sometimes anuria, or oliguria in that the patients pass less urine into the abscess than during its development. This symptom is more definite if there is a sinus whose discharge of urine may be noted. The objective systemic signs corroborate these details.

The objective local symptoms involve the gentle establishment of the site of the stricture by means of a soft instrument passed down to its anterior surface behind which may be felt the stricture itself and then the infiltration which is moderate and indefinite in the earliest period but marked and extensive in the later stages with all the signs of infection, cellulitis, abscess, sinus and fistula, according to the age and neglect of the case. The termination of extravasation is fixed by the duration and violence of the decomposition of urine in the subcutaneous planes of fat and fascia. In the recent cases with prompt operative relief, which is almost the invariable modern experience, the damage may be comparatively little but in older cases, through error of diagnosis or remoteness and inaccessibility to competent urological aid, the destruction may be very extensive so that sinuses and dense, deforming cicatrices mark the recovery. Septic absorption commonly destroys these patients because strictures with extravasation are often also those with other severe complications, as in the bladder, ureters and kidneys, which rapidly break down under the sepsis. Improved methods of diagnosis of stricture and education of the public to know that even when not tight a stricture must be treated are rendering more and more uncommon these complicated and fatal cases in particular and cases of extravasation in general.

**Diagnosis.**—The two classes of cases, recent and old, differ in their points of recognition. Diagnosis of recent cases rests on pain and tearing sensation described by the patient and the sudden passage of the sound with harsh, raw feeling instead of smooth progress along the canal, followed by deviation of the axis, imperfect or absent rotation and hemorrhage. The urethroscopic picture is often final. If complicating leakage of urine occurs it will have the usual symptoms and signs described under extravasation of urine. Diagnosis of older cases rests on history, changes in urinary function, urethral discharge, engagement of an instrument in the false passage while the urethra may be traced away from it, dense infiltration along the passage and the urethroscopic picture.

**Treatment.**—Intervention at the earliest extravasation of either blood or urine is the sole abortive measure.

**Prophylaxis.**—Conservative and consistent treatment of stricture comprises prevention of these severe sequels.

**Management,** as a separate topic, is fully discussed in Chapter IX on the General Principles of Treatment on page 483.

*Curative Treatment.*—The measures are chiefly surgical through the nature of the lesions, both causative and resultant.

Physical measures, as usually recognized, apply only to the recovery, for the absorption of exudate, infiltration and other residua.

Medicinal measures are not available locally except against the urethritis and after surgical relief of the extravasation. As applied to the drainage and dressing of sinuses they are surgical means. By systemic administration the septic or semiseptic state of extravasation is benefited, as shown on page 231 under Septicemia. Serumtherapy, by the methods noted on page 512, belongs in the same category.

Through surgical intervention the stricture is relieved, the bladder drained, and the extravasation evacuated, drained and healed. External urethrotomy by methods shown on page 395 opens the stricture and drains the bladder. Occasionally suprapubic cystostomy is required. The paths of extravasation are followed from the perineal wound and all pockets incised and drained. Stitches are usually omitted and drainage and dressing are on established surgical principles.

*Aftertreatment.*—The immediate measures attend to at least the following details: (1) To the urethritis and urethra as shown under External Urethrotomy on page 399; (2) to the bladder and urine as indicated under the same subject and under Cystitis, on page 173; (3) the sinuses and pockets on general surgical lines; and (4) the general condition of the patient as described under Septicemia on page 235. Remote methods are clearly comprised under each of the foregoing headings and also under Stricture on page 401.

*Cure.*—Pathological restoration is hardly ever reached, as shown under the various subjects just noted. The stricture always requires sounds for life and the infiltrations of the extravasation never totally absorb. Complete symptomatic cure is the rule in well-managed cases. Bacteriologic cure is discussed under Stricture in general.

#### URETHRAL INFECTIONS IN CHILDHOOD AND OLD AGE.

**Gonococcal Infection from Infancy to Puberty.**—*Occurrence.*—Boys are less frequently infected than girls through anatomical protection of the parts.

**Varieties.**—Acute, subacute and chronic, anterior, posterior and anteroposterior urethritis are seen. Complications are less common than in adult life through undevelopment. Gonococcal and nongonococcal types are distinguished.

**Etiology.**—All the factors are the same as in later years. Of special importance are the nongonococcal causes—dentition, worms, vesical and renal disease and faulty diet.

**Pathology.**—The lesions are the same as those in adult life noting the greater rarity of complications.

**Symptoms.**—Subjective symptoms during the prodromata and incubation are usually described by children. The establishment is much the same as that seen in adults.

**Diagnosis.**—A physical examination and laboratory proof of the gonococcus are required.

**Differential Diagnosis.**—As in the adult, distinction must be reached between the gonococcal forms and other varieties, such as catarrhal and croupous urethritis and meatal infections.

**Treatment.**—Expectant methods alone are possible on the same principles as those applied in the adult.

**Gonococcal Complications from Infancy to Puberty.—Occurrence.**—Through physiological and anatomical undevelopment, complications are very rare.

**Varieties.**—Genital and extragenital classifications are observed and under each exactly the same forms may occur as are seen in the adult. The most important extragenital types are conjunctivitis and arthritis.

**Symptoms and Treatment.**—The clinical characteristics and managements are the same as those employed for the adult.

**Gonococcal Infection in Old Age.—Occurrence.**—With the decline of sexual powers infection decreases. The unfaithful infected young wife of an old man is the commonest source of disease.

**Varieties.**—The forms are the same as those seen in vigorous manhood.

**Etiology.**—Coitus with a prostitute is fairly common among ignorant old men, but much less so among the intelligent. Innocent infections in wedlock are not unusual.

**Pathology.**—The lesions are the same as those in middle life with distinct tendency to prostatic infection.

**Symptoms.**—In every respect the clinical features are the same as those during sexual activity.

**Treatment.**—All accepted and conservative measures are applicable.

## CHAPTER VIII.

### GENERAL PRINCIPLES OF DIAGNOSIS.

**Elements of Diagnosis.**—There are four general subdivisions of the subject of diagnosis, and as in the frame of a picture all must be present for the complete object. These elements are: (1) history, (2) physical examination which must be (*a*) general and local by the standard methods of inspection, mensuration, palpation, percussion, and auscultation and (*b*) local by special means, such as bacteriology, instrumentation, urethroscopy, cystoscopy with occasionally its allies, ureteral catheterization and *x*-ray; (3) laboratory examination, embracing the bacteriology of smear, culture and urine, hematology for the complement fixation test and toxic accumulation of blood elements and general urinalysis, and serums, bacterins and phylacogens and the complement fixation test are all new elements in diagnosis and treatment obtained from the researches of modern bacteriology and cannot be disregarded; (4) treatment with its results.

Each will be fully discussed in its proper turn, in its relation with diagnosis. The special instruments and equipment which belong to the science of Urology are detailed in this work as their use for investigation. Such description does not include such instruments as cystoscopes and urethroscopes and their accessories, which are fully noted in the chapters dealing with cystoscopy and urethroscopy, and does not include any notice of *x*-ray apparatus, which would require a volume of its own, although the radiologist is the right-hand man of the urologist.

The aims of examination are the diagnosis of at least the following features concerning urethral infection in general:

1. The determination of discharge by smear, culture and at times inoculation of animals.
2. Inspection of the surface of the lining of the urethra from end to end, including the neck of the bladder and the meatus.
3. Study of the essential glands of the mucosa during the second step just mentioned, which must embrace the glands of Cowper through their ducts.
4. The various sexual organs in direct relation with the urethra, that is to say, the prostate, seminal vesicles and testicles.
5. The blood test for the gonococcal complement fixation test in chronic cases.
6. Urinalysis for elements of infection washed from the urethra with the urine, and signs of renal and vesical disease which may ensue upon the urethritis as complications or be a basis of local ill health on which the gonococcal urethritis has been engrafted.



The social importance of correct diagnosis requires recognition of the nature of the infection on account of its communicability in most varieties of urethritis, and determination of the location, penetration and complications of the disease, because this knowledge is the basis of treatment in the comprehensive sense and of curability. The persistence of the infection is the one deciding element of cure and marriageability and of the possible transmission of unsuspected disease in wedlock. These principles apply to both males and females and become of grave importance when one recognizes the destructive character of gonococcal invasion in both sexes and remembers that the sexual act involves in its close personal contact the primary means of infection and that its normal frequency only multiplies this means. These facts are the reasons why venereal infection should be treated as a special field of medicine in the hands of trained experts, when such are available, and the reasons why even these specialists should spare no scruple or conscientiousness to reach a final diagnosis in every case before treatment, during treatment and before discharge from treatment.

### HISTORY.

**History Form.**—The following outline of history has for years been of great service in the author's private practice and by a system of abbreviations has been reduced to the size of a piece of paper eight by ten inches, so that with the minimum of writing a full record is made in a few moments, largely by crossing out titles with negative findings in the given case, and by using symbols and signs. The points embraced in this form of record follow.

Name; Residence; Nativity; Race; Age; Sex; Civil Condition; Vocation. Case Number; Date—, 19 ; Referred by Dr.—

**Diagnosis.**—Urethritis: number of the attacks, acute, subacute, chronic, anterior, posterior, gonococcal, nongonococcal. Complications; Sequels; Result.

**Former General History.**—Family history, father, mother, brothers, sisters, living and health, dead and disease; wife, female diseases, children and miscarriages.

**Personal History.**—General health with special reference to resistance to infections, duration of ordinary illnesses, catarrhal conditions and other diathesis, previous infectious disease with respect to renal and other complications; weight; appetite; bowels and any other indications of general health. Habits as to alcohol and tobacco.

**Former Venereal History.**—*Syphilis* (pox, great pox, lues, blood disease and hard chancre): date of chancre; diagnosis and treatment by physician, dispensary, druggist or self with internal, inunction, injection or fumigation; duration of treatment. Physical examination as to skin, mouth, anus, lymphatic glands, hair and bone. *Non-syphilitic Lesions*: chancroid (soft chancre, eating chancre, haircut); herpes; warts; number of attacks, date of last attack; diagnosis and treatment by physician, dispensary, druggist or self; duration of

N. ; H ;

Ny. y; M. F. : S. M. W. D. : V.

Case No. ; Date

**URETHRITIS** AC., SUBAC., CHR., ANT., POST., GEN., NONGON.; INCT.

**COMP.** ; RESULT

**SEQL.** ; DR.

**F. G. H.** ; H. B. Alc. ; Tob.; Smokes, Chews,

**Family H.** Father living in good, fair, poor health, dead of

Mother living in good, fair, poor health, dead of

Brothers living in good, fair, poor health, dead of

Sisters living in good, fair, poor health, dead of

Wife, female disease

**Personal H.** (General health

Weight Appetite Bowels

**F. V. H. SYPH.** (Pox, G. Pox, Lues, Blood D., Hard C.) no; Ch. w. m. y. ago; D. & T. by *M.D.*, dispensary, druggist, self with

internal, inunction, injection, fumigation method for m. y., stopped by

**P. E. Skin** ; Mouth ; Anus

**L. Glands** ; Hair ; Bones

**NONSYPH. L. CHANCROID** (Soft C., Eating C., Hair Cut) **HERPES P., WARTS** no; times, Last A. w. m. y. ago;

D. & T. by *M.D.*, dispensary, druggist, self for w. m. y. with caustic, powder, wet dressing, irrigation, stopped by

**Comp.** ; P. E.

Funcle. in U.	Prost. in U.	in jls.	Rheum. in U.	D. & T. by M.D., dispensary, druggist, self for	P. V. H. SX. HB. et. q.	Urethritis	Dech. began	Scald, abs., pres., preputial, meatal, urethral ant., post.	D. U. q.	Blood before, after, with U.	D. & T. by M.D. dispensary, druggist, self; for	Comp. Present: U. Balan.	Paraph.	Funic.	Absc.	P. E. Gen. C.	Bact. E. Smear	Dsch. abs., pres., thin, thick, scanty, mod., copious, mucous, purulent, bloody	U. 1	Lymph.	Epid.
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in jls.	Prost. in U.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.
in jls.	Prost. in U.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.	in jls.
in jls.	Prost. in U.	in jls.	in jls.	in jls.	in jls.	in															



treatment with caustic, powder, wet dressing, irrigation; date of cessation of treatment; complications, character, treatment and result. Physical examination as to scars of lesions, complications or operations.

**Urethritis:** number of attacks, severe attacks, prolonged attack, date of last attack; complications in any attack, balanitis, balanoposthitis, phimosis, paraphimosis, bleeding, adenitis, epididymitis, funiculitis, prostatitis, urethrocystitis, cystitis, abscess, rheumatism in joints affected; special subjective symptoms not covered by the foregoing headings. Diagnosis and treatment by physician, dispensary, druggist or self, for—period; with internal, injection, irrigation methods; ceased under orders or by own volition.

**Present Venereal History.**—Sexual habit, intercourse every—days or weeks, with any or special woman, date of infecting intercourse. Urethritis: duration and incubation of present attack; time of onset of subjective symptoms after intercourse; time of appearance of discharge after intercourse; character: thin, thick, scanty, moderate, copious, mucous, purulent, bloody; scalding, preputial, meatal, urethral, anterior or posterior; diurnal urination and nocturnal urination every—hours; control, urgency, tenesmus; blood before, after or with urination; chordée; special, subjective symptoms not covered by the foregoing headings. Diagnosis and treatment by physician, dispensary, druggist and self for—period with internal injection and irrigation method; stopped by physician or own volition.

Complications (following exactly the same list and form as just stated in the previous paragraph).

**Physical Examination.**—General condition; bacteriologic examination (smear, culture and complement fixation); discharge; thin, thick, scanty, moderate, copious, mucous, purulent, bloody. Urinary specimen I, II, III, IV, V (five-glass test of Wolbarst); edema, balanoposthitis, lymphangitis, foreskin, glans, meatus, urethra, testes, epididymes, cords, prostate, seminal vesicles and groins.

The adoption of such a logical and consecutive scheme as the foregoing insures a careful history as the starting-point of a proper diagnosis and does not require much time after experience as headings with negative findings may be crossed out and symbols employed to save writing.

### PHYSICAL EXAMINATION.

**General Considerations.**—As already stated, the physical analysis of the case must be general and local by the standard methods of inspection, mensuration, palpation, percussion and auscultation, and may be also local by special means, such as bacteriology, instrumentation, urethroscopy, cystoscopy, with occasionally its allies, ureteral catheterization and x-ray.

**General Examination** need not be minute, as the infection is chiefly local in its manifestations, but such factors as temperament, jaundice, anemia, edema, cyanosis, injury, operation and the like, may rapidly be noted as having an influence on the general bodily resistance.

of the case. Temperature should be taken and signs of septic absorption noted in pulse, respiration and general appearance, if fever is present. On the whole it may be said that given good bodily health the infection will be more rapidly and fully controlled than in the overworked, ill-housed, anemic neurasthenic type.

**Local Examination** has been schematically presented in the previous pages as part of the history chart whose headings may now be more fully detailed. By inspection is noted the condition of the foreskin, sheath, dartos, and pubic region for edema and cellulitis, and the scrotum for enlargement of its contents and the groins for adenitis. Lymphangitis may rarely be seen in mixed infections with severe complicating balanoposthitis. A distended bladder may be suspected from suprapubic prominence and reduced respiratory motion. Mensuration belongs more properly to the special instrumental investigation. By external palpation are verified the findings of inspection as to the character and involvement of the edema and cellulitis, and on withdrawing the foreskin the condition of its lining and the glans and then by opening the meatus its edema and other conditions, especially associated chancre, chancroids or other ulcers, and especially the discharge, thin, thick, scanty, moderate or copious; mucous, purulent or bloody. Along the venter of the penis the urethra may be traced for severity of the inflammation, thickenings, nodes, strictures, abscesses, adhesions, sinuses and the like.

In palpation of the urethra, as indicated, an instrument may or may not be within the cavity of the canal, with gain in definiteness of findings by the latter step, which is, however, available only in the late subacute or chronic stages when active symptoms or infection have largely or fully disappeared. Palpation without an instrument may be employed at any period of the disease along both the anterior and posterior portions of the canal and should not be omitted during the first visits of the case and often reveals the conditions just noted. Palpation with an instrument may be done with a steel sound, or, as the writer prefers, with an olive-point, cone-tip, lead-core dilator, which is much less apt to offend excitable foci. Either instrument may be passed only as far as the bulb or into the bladder, which should always be washed afterward as a precaution and moderately filled with warm feeble antiseptic, such as silver nitrate solution 1 in 5000, argyrol 3 per cent., or protargol 0.5 per cent. In the anterior urethra nodules, thickening and stricture are readily determined by this step. Nodules, large or small, few or many, insensitive or tender, without or with adhesion of the skin commonly mark points of involvement of follicles and usually of persistence of infection. Thickening of the urethra as a whole, suggesting a deep urethritis or periurethritis, is less common than single or multiple zones of thickening, which indicate the early stages of infiltration and stricture. Through the rectum, the condition of the bulb and in the posterior urethra disease of Cowper's glands just within the anal verge and of the prostate farther up the bowel are more fully described under rectal examination below.

The limitations of such urethral palpation are that the anterior portion and the bulb are best examined and the posterior portion far less because literally the glands of Cowper and the prostate so closely surround the canal that the latter is inaccessible to the finger. Even in the anterior urethra that portion of the corpus spongiosum which is dorsally attached to the corpora cavernosa is not reached at all. In all circumstances, therefore, the suggestions of urethral palpation must be verified by anteroposterior urethroscopy.

Chorded lymphatics, especially on each side of the dorsal midline, may be traced along the penis into either or both groins, where they terminate in adenitis of congestive neocellular or suppurative type—all commonly pointing to a complicating mixed pyogenic infection usually of the foreskin or glans. The dartos should be felt for local or general infiltrations, or edema and adhesions to the testes or bulb. Each testicle is then examined with the fingers in regular order as to the gland itself, the epididymis in its globus major, body and globus minor, and the vas deferens throughout its extent from testicle to internal abdominal ring. The appearance of overdistended bladder may be proved by palpation from above downward in the middle line and laterally from each side. Tenderness along the groin must suggest inflammation in the vas deferens, lymphatic channels or glands, or the early stages of hernia, which must never be out of view in diagnosis.

Internal palpation or rectal examination should always be part of manual exploration of the case and in the average patient is best performed by the following relative positions of the patient and operator: The patient stoops over the side of the table resting upon his elbows or over a chair seat resting upon his hands, with his feet about eighteen inches apart and rotated inward. This attitude opens the gluteal cleft and relaxes the glutei for ready access to the anus. Having protected himself with rubber gloves or the finger cot with rubber shield, or a rubber finger cot and gauze as shown in Fig. 21, the surgeon stands directly behind the patient and inserts his lubricated index finger into the anus and secures penetration and rest by pressure upon his elbow with his hip of the same side, which without muscular force by the forearm leaves the hand and forearm free for only palpation of the bulb of the urethra, prostate, seminal vesicles, and Cowper's glands.

The other postures for rectal examination are the lithotomy, right or left lateral and knee-chest; but they are of less service than the foregoing position because massage of the prostate and collection of a specimen which are essential to a complete examination cannot be well carried out in these attitudes.

The indications for rectal examination are that it is proper in all cases of urethritis in the male as part of a thorough investigation. Acute forms of the disease may readily be discovered in the bulb, posterior urethra, prostate, Cowper's glands, seminal vesicles and even with certain limitations in the bladder, and chronic forms of obscure diagnosis may be properly determined at least as to their chief focus complication and predominating nature.

Each anatomical part is recognized in regular order and then explored systematically as to size, outline, surface and changes in the consistency, such as hardness, softness, spottiness, sponginess, bulging, pulsation, tension and fluctuation.

The meaning of pain during rectal examination is usually explained as follows: If its site is lateral, the lobes of the prostate may be regarded as involved, provided especially that they also reveal other conditions consonant with the pain. If its site is central and the corresponding region of the prostate is negative for other signs, then it may be assumed that the urethra is severely affected. In any event full analysis of these suggestions must be made with the urethroscope and possibly the cystoscope.

**Bulb of the Urethra.**—The bulb of the urethra is found in the normal course of this passage immediately in front of the triangular ligament and in relation with Cowper's glands and their ducts, if diseased. These ducts empty into it and may in rare cases be traced there. The bulb may be prominent or almost imperceptible according to its condition of inflammation or health, and like the anterior urethra as a whole is best felt with an instrument in the urethra, such as a flexible bougie or a steel sound. As in the other portions of the anterior urethra such examination may reveal nodules, thickening, stricture and sometimes the corded ducts of Cowper's glands, all of which must be duly verified by urethroscopy.

**Glands of Cowper.—Anatomy.**—The glands of Cowper are anatomically between the layers of the triangular ligament and, therefore, just above and slightly lateral to the bulb, which brings them just in front of the apex of the prostate, where they may be grasped between the index finger within the rectum and the thumb upon the perineum and their general condition elicited. The normal gland is not palpable but the diseased organ may show any variety of change from infiltration to abscess and sinus. The examiner should be familiar with all these ordinary changes.

The points of anatomy to bear in mind therefore are that the glands are: (1) between the layers of the triangular ligament; (2) just above and lateral to the bulb of the urethra; (3) directly inside the anal verge and (4) provided with rather long ducts.

**Pathology.**—The facts of pathology to remember are: (1) that the normal glands are not palpable; and (2) that the diseased glands may have either patent or occluded ducts.

**Technic of Examination.**—The posture for examination may be the hototomy, the lateral, the knee-chest or the standing-and-stooing posture which has just been described under rectal examination on page 41, and is much to be preferred to all others because examination and treatment of the prostate may be done without changing the position of the patient in any way. Luys<sup>1</sup> describes a position as follows: For the exploration of these glands the patient should lie flat on his

<sup>1</sup> Text-book on Gonorrhea, 1913, p. 102.

back, the thighs and legs being semiflexed, with the heels together and the knees separated." The steps of the examination are external and internal. External inspection and palpation may reveal a perfectly normal perineum or a distinct protrusion on one or both sides with redness and infiltration of the skin over it. Internal palpation through the anus is done with the palm toward the object examined as in all other procedures and therefore in this toward the base of the bladder. The finger and hand are protected with a rubber glove, stall and gauze shield or stall and rubber shield already described in Fig. 21. After having passed the anal verge the prostate is first reached, its apex recognized and in front of this the bulb of the urethra traced forward as far as possible. On either side of the bulb practically opposite the apex of the prostate are located the glands of Cowper, perceptible only in disease. With the index finger at the proper point within the rectum and with the thumb opposite it upon the surface of the perineum, the mass of this body is carefully explored between them either from the midline outward or from without inward until certain that nothing showing disease is present. Properly done the position of the index finger will correspond with the lower border of the posterior layer of triangular ligament. A diseased gland appears as a body of about pea-size or larger and from hard to boggy in consistence according as the one or the other pathological state exists, with occlusion and without occlusion of the duct. The laboratory diagnosis rests on securing a proper specimen which is possible only in cowperitis without occlusion and by the following steps: (1) flushing of the urethra free of pus, by having the patient evacuate a full bladder or by irrigating the bladder and urethra artificially; (2) irrigation of the anterior urethra as a control of the former step; (3) expression of the contents of the gland, by the same details of massage employed for the prostate but carefully avoiding the prostate in any of the manipulations; (4) evacuation of the boric acid water left in the bladder at the end of the first step into (5) sterile bottles for the laboratory.

In cowperitis with occlusion no specimen may be obtained until the duct opens either in the process of Nature or under the influence of massage, hydrotherapy, electrotherapy, dilatation, and surgical treatment, as described on pages 112 to 115. A specimen must be secured at the time of operation for drainage or extirpation of the gland. As in other diagnoses verification through anterior and posterior urethroscopy must be secured before final deductions may be reached.

**Prostate Gland.—Anatomy.**—The anatomy of the prostate should be well understood. Its apex is immediately inside the rounded mass of the sphincter ani muscle with only the bulb of the urethra below. Its lateral margins extend outward to right and left until in the normal gland a level is reached by its base within easy reach of the examining finger. From the base forward to the apex again the lower surface of the gland is traversed by the finger. In the average normal case therefore, the prostate is approximately the size of a very large horse chestnut, of regular outline, smooth surface, with a middle sul-

between the lateral lobes and uniform firmness as of the flexed biceps in a woman and without sensitiveness. The finger should, therefore, detect general or circumscribed enlargement, nodulations and other irregularities of surface. The gland may be hard or soft, spotty or spongy or of irregular consistence. There may be signs of hypertrophy, general or circumscribed, upon which the infection has been engrafted. The tension of the pus-producing process usually leads to bulging of the gland, with definite elasticity and often with pulsation. Fluctuation is much less common than uniform tension and firmness, probably on account of the thick capsule of the gland. In the nature of the lesion instrumental examination is not possible during the acute periods. When the inflammation has subsided the urethra may be cautiously explored with a soft instrument and the gland examined upon it. Pain and tenderness are prominent features, corresponding with the tension which leads to pressure on the nerves and with the activity of the infection which causes their irritation are prominent over the gland as a whole in generalized prostatitis and over the affected lobe in localized prostatitis.

**Examination of the Prostate.**—The close relation of the prostate with the posterior urethra makes it a very accessible organ for invasion and its anatomical constitution renders it highly susceptible to infection from this canal and its histological structure renders cure of invasion most difficult. One should ever remember, therefore, this clinical fact and along with it the indications of prostatic exploration in every case of urethritis as only one detail of a full examination. Such indications are: (1) congestion present in nearly all cases is mild in purely anterior urethritis, severe in posterior lesions and intense in complications; (2) suppuration, occurring in the late severe cases, is either focal as a single abscess or multiple abscesses, or generalized throughout the gland as a whole. The systemic reaction in these cases may be so profound as to simulate severe infection, such as typhoid fever. The author recalls a patient who was so ill at the advent of prostatic suppuration that he went to bed, summoned his family physician, who diagnosed typhoid fever and treated him for it for nearly three weeks. This treatment was without result. During the absence of the author another surgeon was called in and recognized the prostatic abscess, which should have been perfectly obvious and unmistakable all the time, if the family physician had been careful.

The postures have been fully described in the previous paragraph on rectal examination and need not be repeated here except in the detail of positive preference for the standing-and-stooping attitude; but the preliminaries should never be omitted and include a call by the patient with full bladder, its evacuation to wash the urethra as clean as possible, irrigation of the anterior and posterior urethra to complete the cleansing possibly left imperfect by the urine, and distention of the bladder with normal salt solution or 2 to 4 per cent. boric acid water, with which the results of prostatic examination are washed into several receptacles for examination. The seven-glass test of the author should always be done in advance in order to determine the lesion as posterior.

The precautions are against fainting of the patient, due either to pain or fear, or both, and against an empty bladder, which destroys the support of the gland necessary for a competent diagnosis, and against violence of manipulation, which will bruise the congested or infected gland and excite severe absorption and reaction and against omission of lavage of the bladder and the administration of urinary antiseptics, especially if instruments of any kind have been used. Systemic reaction may be avoided by putting the patient to bed for one or more days and giving him a pill of morphin gr.  $\frac{1}{8}$  to  $\frac{1}{4}$  (or codeine gr.  $\frac{1}{2}$  to 1), quinine gr. 5 and tincture of aconite M i-iii (or nitroglycerine  $\frac{1}{10}$ ) according to his sthenic or asthenic type.

The methods are of two classes: clinical or standard and special or corroborative.

(A) Clinical or standard exploration of the prostate includes:

1. Rectal examination.
2. Massage.
3. Laboratory analysis of secretion.
4. Mensuration.

(B) Special or corroborative examination of the prostate embraces:

1. Urethroscopy.
2. Cystoscopy.
3. Roentgenology.

The other classification of these examinations is into: (A) non-instrumental, which embraces the rectal exploration and laboratory test and massage; and (B) instrumental, which involves mensuration, urethroscopy, cystoscopy and x-ray.

The technic is the same for both the rectal examination and the massage, just stated as the first two methods, except that in massage the manipulation is more prolonged with the purpose of expressing or milking the gland free of its contents—normal or abnormal. With the preliminary preparation already described in the paragraph on internal palpation or rectal examination as to the bladder and urethra, the attitude of the patient and the protection and position of the surgeon, the finger is inserted into the rectum and advanced to the highest part of the gland in the middle line and then passed laterally to the angle of either lateral lobe. The anatomical arrangement of the ducts must be here borne in mind, on the point that they pass radially toward the urethra on all its aspects but chiefly along the floor in the general region of the colliculus. Therefore, in order to drain the acini properly, the pressure must be placed and directed in the same general manner. The author therefore prefers to make pressure lateromesially beginning at the angle of one lateral lobe and passing step by step until the apex of the gland is reached and then to repeat the same procedure on the other lateral lobe and finally on the middle lobe over the urethra. It is certainly a mistake to perform massage in a more or less irregular manner from side to side. The proper action is a scooping motion over the field as just described.

The clinical factors developed during prostatic examination and



massage may be summed up as follows: (1) congestion is shown by softness and slight enlargement, somewhat like the parallel condition in the skin; (2) tension represents the next step with elasticity and firmness; (3) a single abscess without evacuating sinus possesses prominence, elasticity, firmness, heat, tenderness and sometimes fluctuation, either in a definite portion of the gland or its whole body; (4) a single abscess with evacuating sinus possesses a soft spot where the prominence had previously been, easily depressed with an outflow of pus; (5) multiple abscesses without or with sinuses will be indicated by prominences or depressions with the other separate features already stated.

The laboratory analysis of the secretion is the next method and is really part of the preceding detail. Only sterile receptacles should be employed, which are best a glass funnel and bottle (to avoid pouring from a graduate into a bottle with risk of contamination), standing either on a stool between the patient's knees or held beneath the penis by the patient himself or an attendant. In cases of much disease of the prostate, a rather copious specimen will be secured by allowing it to drip from the urethra or stripping it out into the receiver. This is specimen No. 1 and subsequent specimens are secured by having the patient evacuate the fluid previously passed into his bladder, which may constitute several additional bottles. These should be of sufficient size to permit the four-glass test for clinical judgment of the case exactly as though urine were under inspection. All the bottles are then sent to the laboratory for full physical, chemical, microscopic and bacteriological examination and report, which will be consonant with the clinical findings.

The microscopic features are shown in the illustrations on page 315, which have been taken from the work of Oberlaender and Kollmann,<sup>1</sup> and their modern interpretation is contained in the abstract of Young's paper on pages 317-318.

Mensuration is the next procedure and is the first strictly instrumental step, involving the use of flexible or rigid instruments, with preference for the former. The flexible instruments may be the double-headed bougie-à-boule of Pasteau having the centimeter graduations on its shaft, or a special catheter suited to the case with a lead core dilator in it as an obturator, to afford suitable resistance of the urethra. The olive head of the bougie-à-boule causes much less distress than the cone head and should always be used. The rigid instruments may be any sound or catheter accepted by the urethra, with special emphasis on the advantages of the author's model of irrigating sounds in permitting lavage of the bladder—a procedure which had best be regarded as essential to this work. The really technical steps are that the apex of the prostate is carefully located with the finger in the rectum and then the bougie-à-boule, catheter or sound is advanced into the bladder a distance noted on the shaft of the instru-

<sup>1</sup> Die Chronische Gonorrhoe, Leipzig, 1901.

ment at the meatus. Here again the graduated instrument of Pasteau and the catheter or irrigating sound of the author all determine the point of entrance into the bladder accurately, either by the jump of the ball-head through the sphincter or the gush of urine. The diagnostic points are summed up in the urethral length, direction and deviation and the prostatic thickness with other characteristics of the gland—all in exact analogy with the palpation of the urethra on indwelling instruments. The chief justification of the use of rigid instruments is that by rotation and withdrawal and similar manipulations it is possible to estimate the protrusion of the inflamed gland into the bladder with deformity of its floor. In gonococcal conditions two facts must never be forgotten, however, (1) that the passage of instruments is often difficult or impossible and should always be followed by lavage and sterilization of the cavity of the bladder, and (2) that, if possible, the urethroscope and the cystoscope should be given preference, because they permit inspection of the bladder and the urethra before the palpation is attempted—to the mutual corroboration of both steps.

*Urethroscopy, cystourethroscopy and cystoscopy* are the last methods of examining the prostate and should be considered together because correlated intimately. The science of urethroscopy is considered in Chapter XII in final detail, but its broad principles belong here and include both anterior and posterior urethroscopy at the same sitting and preferably with a water-dilating instrument, because this type unfolds the crevices of the canal and permits inspection of recesses which would otherwise escape notice. Its limitations, when applied to prostatic disease in the strict sense, are great because it reaches only the surface of the urethra while the diseased prostate is beneath this surface. It follows, therefore, that one may judge of prostatic disease only in accordance with the condition of the urethral mucosa in the direct light of the urethroscope and in the reflected light of the various other clinical findings. Such features of the urethral mucosa are in the epithelium, the anatomical details and the ducts and embrace color, vessels, edema, elasticity, crypts and ducts, granulation tissue and ulcers. The colliculus or verumontanum is the chief anatomical feature containing the utriculus masculinus and the ducts of the seminal vesicles slightly in front and on either side of it. Likewise important are the prostatic fossettes on either side of the colliculus and slightly behind it containing along their floor the largest number of prostatic ducts.

As a matter of routine and good faith with the patient the posterior urethroscopy should be followed by the same investigation of the anterior canal and preceded by investigation of the neck of the bladder. In the prostate the response to a urethritis varies from a simple sympathetic congestion to infection and suppuration, so that in the acute congestive conditions the mucosa will be inflamed but hardly edematous, but in the severe infective lesions the whole process is much more marked and obvious. In the chronic conditions the ducts of the prostate will be found patent and discharging thick strings of mucus

ucopus or pus easily detachable or adherent to the granulations which surround the ducts and fill in the folds of the mucosa, especially the prostatic fossettes.

In cystourethroscopy the effort is made to explore the neck of the bladder both within the viscus and over the surface of the muscle, in collaboration with cystoscopy.

Cystoscopy is fully considered in Chapter XIII, but must be here mentioned on the broad basis of including at the same sitting the five zones of the bladder described by the author<sup>1</sup> as the ureterotrigoanal, subperitoneal, urachal, retropubic and cervical, with both the examination telescope and retrovision telescope.

Inasmuch as the prostate surrounds the neck of the bladder entirely, a portion of the surface of the bladder near the neck must be omitted from the examination. Its limitations during prostatic disease of ethral origin in the strict sense duplicate those already noted in urethroscopy in the preceding paragraphs and involve recognition of the fact that congestion of the trigonum is the only sign which the examiner may give and varies in degree with the severity of the prostatic invasion from congestion to suppuration. Thus it cannot be regarded as a part by itself of final diagnostic value. The dangers of urethroscopy and cystoscopy during a urethritis are the same as those attending penetrating these regions with any other instrument, with the added advantage, however, that the sheath of these inspection instruments always permits thorough lavage of the bladder and urethra; but this does not correct the likelihood of intensifying a mild acute urethritis, or of lighting up a subacute and declining stage, solely by the presence of a mechanical device in the inflamed and weakened passage. Thus it is that in chronic urethritis these instruments find their first and most advised field of usefulness so that one may wisely say that the better means of clinical diagnosis are sufficient for all practical purposes in acute disease of the prostate, because, as in the urethra, violent disturbance in the gland may follow. A congestion may be converted to an infection and a superficial folliculitis advanced to an abscess. When in doubt it is safe to omit these special investigations and to rely only on data clinically obtained.

Röntgenology as related to prostatic conditions is fully discussed in Chapter XVII, on Diseases of the Prostate on page 951. Manifestly it is more suitable for hypertrophy and allied diseases than for inflammation.

**Seminal Vesicles.—Anatomy.**—The seminal vesicles are at each angle of the prostate gland and are the outermost and highest of the accessory structures near this point, which from without inward are the seminal vesicle, the ampulla of the vas, and between these two at a slightly higher level than their outlets into the prostate, the ureter. The vesicle extends as a rule higher than the implantation of the ureter into the bladder. The normal seminal vesicle is not palpable

<sup>1</sup> Loc. cit.

excepting on a full bladder—a condition which should be presented by the patient or produced by the surgeon before proceeding. It is a soft, wormlike mass not within reach until after the prostate has been passed and then best by touching the pelvic wall first and sweeping the finger inward until its prominence is detected and then by traveling up and down along this over the entire organ. As in the prostate the examining finger should detect general or circumscribed enlargement, nodulations, and other irregularities of outline and surface, and changes in the density, such as hardness, bulging, pulsation, fluctuation and involvement with the perivesicular structures.

**Pathology.**—As in the prostate the vesicles may show: (1) congestion of varying degrees; (2) suppuration without occlusion and with drainage or with occlusion and without drainage and (3) perivesicular involvement.

**Technic of Examination.**—The seminal vesicles become important and the indications of examination great during a urethritis through their close relation with the urethra, by their ducts which enter the canal within the body of the colliculus, where they are ordinarily visible to close inspection and where continuity of the mucosa from the urethra along the duct and into the seminal vesicle renders the transit of the infecting organism easy. Such are the general anatomical indications while the histological conditions of these sacs render relief of profound disease most difficult. Therefore prevention through early examination and diagnosis is essential when possible.

The postures are as in rectal examination of the prostate by first choice the standing-and-stooing attitude; but the others may be employed, such as the lithotomy and the lateral positions, although they do not so readily permit collection of the laboratory specimen. The preliminaries are the same as those given for prostatic massage but will bear repeating for clearness and emphasis: (1) the seven-glass test of the author for thorough diagnosis of the condition within the urethra itself; (2) a full bladder presented by the patient or produced by the operator; (3) evacuation of this distention to still further clean the urethra; (4) irrigation of the anterior and posterior urethra, provided the seven-glass test has not been done and (5) distention of the bladder with sterile normal salt solution which in evacuation will wash the products of massage of the seminal vesicles out of the urethra and into the sterilized receiving bottles.

The precautions do not vary from those stated for prostatic work in the previous paragraphs and embrace syncope, failure of diagnosis by not carrying out the preliminary preparations, as stated, trauma by carelessness and roughness in manipulation, infection of the bladder by direct contact and systemic reaction.

**Methods of Examination.**—There are commonly two forms: (A) clinical and standard and (B) special and corroborative.

(A) Clinical or standard examination has the following steps:

- (1) Rectal examination.
- (2) Massage.
- (3) Laboratory examination.



(B) Special or corroborative examination involves only one step:

(1) Urethroscopy.

(2) Roentgenology.

The technic of each of the foregoing procedures is as follows: There is no essential difference between the prostate and the seminal vesicles so far as rectal examination of each is concerned, so that under the former subject, as just outlined, the reader may obtain all the data of preparation of the patient, protection and position of the examiner, posture and procedure for the systematic palpation of each of the seed sacs. It is well to remember, however, the three pathologic conditions ordinarily found:

1. Seminal vesiculitis without occlusion and with drainage; (2) seminal vesiculitis with occlusion and without drainage and (3) perivesicular infection. The laboratory specimen is best received into sterilized funnel and bottle to prevent handling, as with graduate and then funnel and bottle. Specimen No. 1 is secured by allowing the contents of the urethra to drip into the receiver and is possible only when there is no occlusion of the ducts. Specimen No. 2 and later may be obtained by allowing the patient to evacuate the fluid within his bladder into the desired number of bottles. Separated specimens may be obtained by massaging one vesicle at one visit and the second sac at a later visit or by going through the preliminary steps after the first viscus has been emptied. The prostate must not be touched in such a separation massage. The laboratory investigator takes smear and culture tests from as many specimens as necessary to reach a diagnosis and must regard the shreds and slugs of mucus, mucopus or pus and the presence or absence of gonococci and other infecting organisms. Spermatozooids are commonly best recovered in the living state in specimen No. 1, as the fluid in the bladder, especially if boric acid water, rapidly kills them. It is needless to say that inquiry must be made before attempting to secure a specimen as to whether or not the patient has had coitus or a nocturnal emission within twenty-four hours. Vesicles thus emptied do not permit a satisfactory examination, which in either of these events should be postponed for a few days.

The clinical factors deduced from such an examination follow:

(1) normal vesicles are palpable not at all or with difficulty; (2) enlargement, unilateral or bilateral; (3) nodulation, general or local, single or multiple; (4) irregularity of form, associated with perivesicular disease; (5) density, elasticity and tension, due to infiltration or abscess; (6) outflow or dripping from the urethra in cases without occlusion and with drainage; (7) no outflow from the canal in sacs with occlusion and without drainage or in vesicles emptied by physiological action; and (8) pain and sensitiveness even on gentle pressure. As stated in the paragraphs on the prostate on page 314, cases without drainage will sometimes declare themselves by waiting for the occlusion to be cured by Nature or by treatment.

The microscopic features are the epithelium from the lining of the ducts and the sac, blood cells, pus cells and mucus, spermatozoa

living or dead, and the gonococci or other organisms. Germs of infection other than the gonococcus are extremely important and should always be looked for in cases of so-called gonococcal arthritis, because the streptococcus and its allies are as frequently the cause of such joint involvement as the gonococcus and unless the exact nature of the infection is determined, serotherapy with the wrong organisms as its basis will be a failure and sometimes a danger.

Urethroscopy and its application to the Seminal Vesicles are fully discussed in Chapter XII and Chapter V, on the Complications and Sequels of Chronic Urethritis on page 321, in the notes on the work of Thomas and Pancoast. These authors were among the first in the United States to inject the vesicles with preparations opaque to the x-ray.

### LABORATORY EXAMINATION.

**General Importance.**—The development of all laboratory investigation in medicine, as a science and an art, has been so great within the last few years that this department of diagnosis cannot be omitted advisedly in any conscientious service of the patient. Precisely as the laboratory expert aids in the diagnosis of the clinician by furnishing all the elements therein which he can supply, so should the clinician without reserve give to the laboratory worker all the facts within his knowledge so that his conclusions may take due account of the clinical aspect of the case. It is certainly an error in judgment to hand a laboratory specialist a bare specimen without comment and expect him to give a final opinion. If such knowledge is regarded as likely to compromise the independence of such opinion, then another laboratory man should be selected, who cannot be thus biased.

It is therefore necessary to supply to the laboratory the main and broad facts of the subjective history, the objective observation and examination and the suggested clinical diagnosis.

In urological investigations the specimens are usually obtained among the first essentials of the case, but this subject is considered in this part of this chapter after physical examination and special local examination, in order to conform with the fact that the results of the laboratory work are usually considered after such clinical knowledge has been obtained. On account of its importance urethral discharge of any character must be investigated by smear and culture, the urine analyzed for the same products of infection and for signs of essential or complicating disease in the upper urinary tract and the blood test must be performed for the gonococcal complement fixation as estimate of the condition of chronic cases. The general aims of examination are more fully discussed in the opening paragraphs of this chapter.

**Examination of Discharge.**—**Definition.**—Any abnormal urethral product, whether as free pus or as shreds appearing in the urine only, must clinically be regarded as discharge.

**Varieties.**—From this statement it will be realized that the varieties are two: (1) free, which is copious and will infect the clothing, genitals



and thighs unless a suitable dressing is worn and (2) masked, which is not apparent externally at all but appears only in the urine as shreds and masses of pus which must be washed out either by the urinary stream or by irrigation with a syringe. The free discharge should be settled as to its source either from the urethra or from the foreskin, by the subjective statements of the patient concerning ardor urinæ and by objective examination including washing of the meatus, retraction of the foreskin and study of all its recesses. This retraction must be thorough because it often happens that until the last folds are smoothed out the source of the pus remains undetected. A balanoposthitis, as explained under this complication on page 94, may be simple, purulent, verrucous, chancroidal, chancrous and finally ulcerous and any of these varieties may produce little or much discharge, whose source must be known and precise bacteriologic factors determined before one may wisely proceed. Where retraction of the foreskin cannot be performed, through edema or infiltration a Chetwood urethroscope may be passed through it and then made to explore the cavity thoroughly, with the obvious disadvantage that very little of the cavity of the foreskin may be seen at one time and that the field is constantly flooded with excess of pus, unless, as should always be done, subpreputial irrigation is previously carried out. After such cleansing the urethroscope may be more readily employed and sometimes without it the urethra may be seen to be the source of discharge, but the foreskin might in such a case of phimosis remain yet to be diagnosticated.

The irrigation of the foreskin is very well carried out with the Valentine nozzle, shield and cutoff, with a female catheter mounted according to the author's method, as shown in Fig. 18 on page 86. This device permits irrigation from the deepest recesses of the foreskin outward and under sufficient pressure to balloon the foreskin as a whole and thus add to the hydraulic cleansing. Or the hand bladder syringe and short rubber catheter may be used. The patient may be given the Acme subpreputial syringe shown in Fig. 7 on page 49, for use at home.

**Free Discharge of Balanoposthitis.**—The form varies as follows: (1) the simple type has mucopus with a characteristic odor, and with only superficial chafing of the lining; (2) the purulent form has copious pus in the strict sense, also characteristic odor and usually local or universal more or less deep erosion of the surface, and is seen in gonococcal and its mixed infections and in verruca; (3) chancroidal lesions vary so widely in their penetration of the surface as to make description here out of place but their discharge is mucopurulent, purulent and sanguineous according to severity and (4) chancrous manifestations belong to the same complex type with a discharge which is serous, seropurulent, purulent and even sanguineous according to severity and destructiveness. Only a careful clinical and bacteriological investigation will distinguish these forms from each other.

**Free Discharge of Urethritis.**—Scientific diagnosis requires the following factors to be known, in addition to bacteriology: Cause,



occurrence, quantity, color, odor and consistence. The cause may be chemical from strong hand injections taken in self-cure, or an infection from without the body in the venereal sense or from within the body in the systemic sense, or from functional disorder as in relaxation of the prostate. The occurrence may be persistent throughout the day and night, rapidly recurring after the urine has cleansed the urethra, or intermittent through the declining stage of a general urethritis or through the evacuation of minute or large abscesses in the mucosa itself or in the prostate, as examples. The quantity varies widely and is conveniently estimated in terms of the number of dressings necessary in the day in cases with continuous discharge, exactly as one estimates menstrual flow in terms of the napkins used. Or the quantity may be mere drops at frequent intervals through the day or only in the morning as the "morning drop," or crusts and gum at the meatus dependent on the rate with which evaporation and drying occur, or finally mere shreds, flakes and floaters in the urine alone without external manifestations. Another estimate of the free pus in continuous discharge is furnished by the number of discolored glassfuls voided in the various multiple glass tests as hereinafter discussed. The color may be the yellow or greenish-yellow of true gonococcus infection, whitish or yellowish-white of the pyogenic, grayish to blue from the *Bacillus pyocyaneus*, whitish and viscid, much like oyster juice, from seminal and prostatic fluid and watery and sticky like glycerin in mucous and catarrhal conditions. The odor is that of smegma in balanoposthitis and fishy in seminal elements, but odor is commonly absent in the majority of urethral discharge. The consistency varies greatly. It is thick like thin honey, or thin and watery like diluted milk, according to circumstances of the admixture of serum with it. It may be uniform in consistence or filled with masses, shreds and flakes, like driftwood in a bay. It may dry readily on the clothing with or without stain or remain thick and gummy. These latter characteristics are important in women in whom commonly the normal mucus from the vagina does not stain or stick. It may be so thick as to form a gum at the meatus because it does not evaporate, or become a crust through exactly the opposite circumstance, so that a scab-like mass must be broken by the urine or the fingers before any discharge within the meatus may be recovered.

**Bacteriology.**—Bacteriology of the genital apparatus in both sexes is highly varied in both health and disease and a partially complete list of the various organisms encountered is shown in the paragraphs on nongonococcal bacterial urethritis in the Chapter on Acute Urethritis and in the paragraphs of this chapter noting the bacteriology of the urine, respectively, on pages 22 and 469.

The bacteriology is beyond question the most important of all characteristics of the discharge and is determined by smear, culture and inoculation as set forth in the sections on Acute and Chronic Urethritis on pages 25 and 265, and those on Tuberculosis on page 131. The smear is obtained by first thoroughly cleansing the foreskin

and meatus with a sterile gauze or cotton sponge moistened in an antiseptic, such as boric acid water. The methods are with two slides, cotton swab and slide and platinum loop and slide.

1. *Two-slide Method*.—A drop of the free discharge is then gently stripped from the urethra or allowed to drop of itself upon one end of a microscopic slide, suitably prepared and sterilized. The edge of another similarly prepared slide is laid across the far end of this deposit and then drawn with only its own weight evenly along the slide from end to end, thus wiping the drop out into a very thin "smear." The technic is exactly that followed in the preparation of blood for staining and microscopy.

2. *Swab and Slide Method*.—If the discharge is less copious, then a cotton swab on a toothpick, singed in the flame, may be passed into the urethra for an inch or more, rotated gently in order to gather up as much pus as possible and then withdrawn and passed along a slide from end to end exactly like a whitewash brush and thus produces a thin smear. One hardly ever finds a patient intelligent enough to prepare smears himself, in both the details of sufficient thinness and absence of contamination; such specimens should, therefore, be always prepared by the urologist himself or a suitably trained attendant.

3. *Platinum Loop and Slide Method*.—If the discharge is still less as in chronic cases after the preparation of the patient and slides as just stated, a platinum loop is flamed red hot, cooled and while the meatus is held open by the patient or the surgeon without having touched its lips, the loop is passed edgewise into it and along the roof of the canal for an inch or more with great gentleness so as not to cause bleeding. At this point it is turned breadthwise and withdrawn along the floor of the canal as a blunt curette, scooping in its course whatever pus and detritus are present and should emerge with its loop and shaft covered. Such collection is then deposited on a slide and with the wire itself teased and streaked into a smear.

The fixation of a smear may be done with heat but equally well and more rapidly by flooding the slide with equal parts of 95 per cent. ethyl alcohol and anesthesia ether and allowing them to evaporate. This simple step never spoils the specimen by overheating, requires no watching and may be done in the mailing box just before sending it to the laboratory.

The culture of urethral discharge is more important than the smear alone and should always be undertaken as the essential part of this element in the diagnosis, because the culture essentially involves smear examinations later. This might be called the platinum loop culture medium and smear method. The patient is prepared exactly as for taking a smear with the loop just described in the preceding paragraphs. The specimen on the wire is gently streaked along the slant culture in the tube which is immediately sealed with the cotton plug and then in the writer's preference this is singed and covered with sterile gauze secured by an elastic to the top of the tube. The clinical report for the laboratory is folded around and fastened to the tube

with a narrow piece of adhesive plaster, below the label for laboratory memoranda.

At least three tubes should be taken at each sitting, of which one, labelled with the patient's name, should be kept at room temperature in the urologist's office and known as the control tube. The other two tubes are kept in an incubator at blood temperature until called for by the laboratory, whose messenger should carry them in his inside pocket close to his body in order to prevent any fall in temperature which always kills the gonococcus, or makes it grow imperfectly.

The control tube at room temperature will show abundant growth of the *Micrococcus catarrhalis* and other organisms if present, but not of the gonococcus. If, therefore, the laboratory reports gonococci absent and the nature of the other organisms in doubt, the presence of such growth in the control tube is strong evidence but not absolute proof of the catarrhal nature of the lesion. All culture of the urethral discharges for the gonococcus rests on special culture media as discussed in Chapter I on Acute Urethritis on page 26, and has its basis only in media containing serum from blood, hydrocele fluid or peritoneal effusion.

A specimen report form of convenient arrangement is the following in assisting the urologist to include all the data essential to proper judgment of the case by the bacteriologist.

#### CLINICAL NOTES CONCERNING SPECIMEN

Name .....	Date .....
Ward room .....	History No. ....
Nature of specimen .....	
Where obtained .....	
How obtained .....	
What is requested .....	
Remarks .....	
.....	
Clinical diagnosis .....	Service of Dr. ....
.....	Patient of Dr. ....

Frequent transplantation from the culture tube to Petrie dishes must be made before a final separation of the various organisms present may be made. This fact should be explained to patients, otherwise the delay in the report which this procedure necessitates will lead to discontent.

Inoculation of animals as a diagnostic aid in urethritis is far less valuable than in diseases of the bladder, ureters and kidneys and is therefore much less frequently applied in the former than in the latter; but it may be reserved for difficult and obscure cases as determined by the wish of the laboratory experts.

**Repetition of Tests.**—Smears, culture and inoculation are the diagnostic steps which permit the urologist to determine the course of the disease, which is measured by the slow disappearance of the organisms in pure or mixed culture and finally of the products of active pus-formation.



The urologist should, therefore, be prepared to make rather frequent observations in every case as the measure of his treatment and not be satisfied with the initial diagnosis alone, no matter how completely made. Before the patient is released from treatment a thorough bacteriological diagnosis must be made.

The *complement fixation test for gonorrhea*, while a very recent discovery, is of great importance and should always be employed before the patient is discharged from treatment. Its final interpretation is still to be fixed by experience, but several authorities regard it as one of the determinators of marriageability, in the effort to avoid obscure sources of infection. It is generally believed that patients who have had gonococcal infection for a long period or with profound complications show this test in various positive degrees, and that patients who have reached a speedy cure and without complications show it either not at all or only in slight and temporary degree.

**Masked Discharge of Urethritis.**—Filaments, also known as shreds, threads and flakes, are, as already described, that discharge which is not copious or free, does not get upon the body or clothing and exists chiefly within the urine. Its importance rests on the element of diagnosis discussed in the opening paragraph of this chapter, as the persistence of infection. The diagnosis of these shreds in full detail, therefore, involves the recognition of whether or not the patient is without infection and will not transmit the disease to the marriage bed and through this to the eyes of offspring. The details of diagnosis must include recognition of the source, number, size, density, buoyancy, consistency of the threads and the character of the urine in which the threads appear. In brief, macroscopic and microscopic examination of the mass discharged is absolutely necessary and will respect the following broad facts:

*Macroscopic Examination.*—1. As to source, the threads may come from any portion of the mucosa, the essential glands of the mucosa, or the sexual glands or their ducts emptying into the urethra. They may arise by the process of exfoliation at various spots of the lining of the urethra or any of the acini or ducts of the glands or by the thickening of normal secretion into plugs which are thrown out by the glands. The process is the same in kind but different in degree if the sexual glands are the source.

2. As to depth of origin, the flakes may as just indicated be superficial or deep, so that casual examination is an injustice to the patient, because it involves merely inspection of the meatus and perhaps urine and often release of the patient from treatment long before the deeper parts of the mucosa have been freed of infection.

3. As to number, the filaments may be very few so as to make close study of the specimen of urine necessary, or so numerous as to be easily observed and described by the patient himself.

4. As to size and form, the shreds may be long and threadlike, short and hoodlike (comma shreds) or long and thick, much like masses of nasal mucus, occurring in lumps and clumps.

5. As to density, consistency and buoyancy, the flakes may float readily about the upper layer of the urine in which they slowly dissolve, or they may sink with great rapidity and remain at the bottom of the glass unless disturbed by shaking.

6. As to color, the mucous shreds are transparent and almost watery, or filled with fine whitish spots throughout their rather extensive mass and the pus shreds are opaque and whitish-yellow or yellow.

The mucous and pus filaments, in recapitulation, may be said to differ in the following details: (1) The mucous specimens are a few, large, cloudlike, light, floating masses usually without infectious elements, often containing in their midst patches of shed epithelium. In general they represent the last few weeks of catarrh following the suppurative urethritis. The urine is commonly clear. (2) The purulent specimens are usually many small or large of any ordinary form, heavy, sinking to the bottom and possessing organisms, whose character must be known. The urine may be slightly purulent or clear. In general they represent an uncured case with minor or major complications.

**Multiple Glass Tests.—Classes.**—Multiple glass tests are divided into three groups: (a) those without irrigation and without dyes, among which the most prominent are the Thompson two-glass test and the Luy's four-glass test and (b) those with irrigation and without dyes, among which the best are Wolbarst's five-glass test, the author's seven-glass test, Kollman's five-glass test and Young's seven-glass test, and (c) those with irrigation and with dyes, among which are included as the choice, Krohmeyer's and Lohnstein's.

**General Principles.**—Before discussing each it is well to understand the broad facts of the quality of the urine obtained and the meaning of the steps in securing it. The quality of the urine may be clear or turbid. The former condition permits ready examination of foreign elements, but the turbidity must be tested as it need not depend on pus alone. Hayden<sup>1</sup> gives the following meanings of cloudy urine under such investigation after Ultzmann:<sup>2</sup> "By gradually heating the upper half of the urine (in a test-tube) to boiling, the opacity.

Vanishes.	Increases.			Remains unchanged even after addition of acetic acid.
If due to acid urates.	If due to earthy phosphates, carbonates or pus-corpuscles. Add one or two drops of acetic acid.			The dimming is caused by catarrhal secretion or by bacteria.
	Dimness vanishes with evolution of gas; carbonates.	Dimness vanishes without evolution of gas; phosphates.	Dimness remains unchanged; pus.	

<sup>1</sup> Venereal Diseases, 3d edition, p. 28.

<sup>2</sup> Ultzmann, Vorlesungen über Krankheiten d. Harn., 1892, p. 3.



The general basis of the multiple glass tests should be thoroughly comprehended after the quality of the urine has been settled, and embraces the following general details: (1) The cavity of the urethra should be flushed clean with the urine or with artificial means, in the anterior urethra first. (2) The posterior portion must likewise be flushed clean by either or both means. (3) It will be noticed at once that the urine of itself cannot flush the urethra except from the neck of the bladder forward, and, therefore, carries with and before it much that is in the posterior urethra into the anterior urethra, so that it is not possible after micturition to state with absolute certainty the source of shreds or pus. (4) Unless the patient has about five hours' urine in his bladder he will not have sufficient for suitable flushing of the urethra at all. (5) These limitations of natural evacuation make irrigation of the urethra an essential basis of these four-glass and five-glass tests which are now accepted as worth while, and by means of irrigation the anterior urethra is first cleansed with or without the instillation of dyestuffs into it, before the accumulated pus in the posterior urethra is obtained.

**Multiple Glass Tests without Irrigation and without Dyes.**—Thompson's two-glass test<sup>1</sup> consists of urination into two rather large glasses. Its fallacies are summed up in the following principles:

1. Too little urine permits the patient to wash out his urethra so deficiently that even the anterior portion is not properly cleansed. The first glass will contain perhaps a half-inch of urine and there is no second glass.

2. Too much urine causes the subject to wash the urethra as a whole so that in the first glass all the pus may be accumulated and the second glass be clear although the lesion may be in the posterior urethra.

A very safe rule is to have the patient call with about five hours' excretion in his bladder. In most subjects this supply will reach about 200 to 250 c.c. and furnish two good specimens and thus avoid both fallacies noted above. The Thompson test, even in these circumstances, is only an index and not a diagnostic certainty.

Some of this difficulty is corrected by having the glasses of not more than 100 c.c. capacity (3 to 4 ounces), which compel the patient to change glasses before he has emptied an ordinary bladderful of 200 to 250 c.c. (6 to 8 ounces). Furthermore, the character of the shreds may indicate their source in anterior or posterior urethra, especially when combined with carefully taken subjective history, objective examination and, most important of all, with urethroscopy. It must never be forgotten that pus and detritus in the anterior urethra may have gravitated thither from the posterior urethra after the former is fully cured—a diagnosis which is very difficult to make without the urethroscope as the final verifier.

The interpretation or diagnosis rests on the condition of the contents of the two glasses, which may follow these three variations:

1. Glass I, cloudy; Glass II, cloudy.

<sup>1</sup> Clinical Lectures on Diseases of the Urinary Organs, 8th ed., 1888, pp. 12 and 448.

2. Glass I, cloudy or slightly turbid; Glass II, clear, or clarified of phosphates and carbonates by the steps noted in the previous paragraphs and either or both filled with filaments as described.

3. Glass I, clear; Glass II, clear.

The accepted indications of the foregoing conditions of the urine in two glasses follow. If both glasses are turbid there may be present either (a) generalized acute anterior and posterior urethritis, (b) a purulent lesion of the bladder and (c) a purulent disease of the kidneys and ureters in either or both sides.

If Glass I is turbid and Glass II clear, there is usually present a declining urethritis, commonly anterior in its situation, but less often anteroposterior, whose moderate products are washed into the first glass, if too large by a copious flow of urine.

If Glasses I and II are clear, as passed or as freed of phosphates or carbonates as above, and contain filaments having the foregoing characters, there is usually present chronic anteroposterior urethritis with or without complications.

It will be noted the two-glass test is, therefore, incompetent to decide uncertainties, which have rendered the artificial cleansing of the anterior urethra by irrigation absolutely essential in order to separate the products in the two major segments of the canal from each other.

*Luy's Four-glass Test.*—This writer<sup>1</sup> also calls this the practical method and claims that urination into four glasses is usually adequate for diagnosis, on the ground that if the Glass I has not cleansed the anterior urethra, Glass II and Glass III will do it progressively. If the Glass IV shows heavy flakes while the second and third contain none or but few, posterior urethritis is proved. In general, therefore, distinction between the two parts of the canal, anterior and posterior, as to lesions is given by Glass II and Glass III. This method contains the fallacy of almost all other methods in omitting investigation of the bladder as a source of pus and detritus with the catheter.

Luy's tabulation of diagnosis is in these terms:

I	{ First glass clear or turbid, with heavy filaments; second, third, and fourth glasses clear, without filaments.	=	{ Anterior urethritis or posterior urethritis.
II	{ First glass clear or turbid, with heavy filaments; second and third glasses clear, without filaments; fourth glass clear or turbid, with heavy filaments.	=	{ Anterior urethritis and posterior urethritis.
III	{ First glass clear, with a few heavy filaments; second and third glasses clear, with a few or no filaments; fourth glass turbid, with heavy filaments.	=	{ Posterior urethritis chiefly.

**Multiple Glass Tests with Irrigations and without Dyes.**—**General Principles.**—Irrigating multiple glass tests recognize the need of securing the contents of the anterior and posterior urethra and include the methods of Wolbarst, Kollmann, Young and the author, which do not use a dye.

*Wolbarst's Five-glass Test* is a good one because it distinguishes the contents of the anterior urethra, posterior urethra, bladder and prostate

<sup>1</sup> Text-book on Gonorrhea, 1913, p. 90.



with the seminal vesicles with reasonable accuracy. Like all other multiple glass tests, it is not infallible and should be corroborated with objective examination and urethroscopy. Wolbarst's original method consists in passing the catheter into the bladder after the anterior urethral glass and control glass have been secured. This makes the bladder third of the series, but this method has the objection of greater risk of infecting the bladder especially when the posterior urethra is rather full of exudate, either from its own mucosa or from the prostate and vesicles. The author has therefore modified the Wolbarst test to agree in this detail with his own seven-glass test, which adds separation of the contents of the prostate and the right and left seminal vesicle severally from each other as hereinafter noted and gives, therefore, still more thorough indication of the condition of the lower urinary tract and its annexed sexual organs and even forms a lead to lesions of the bladder, ureters and kidneys.



FIG. 120.—Irrigation for the anterior urethral glass in the author's seven-glass test (original). After standard drapery (Fig. 15) a large sterile glass is held by the strap at the upper end of the Wolbarst basin. The left hand supports the catheter within the penis and makes it coil within the glass. The right hand makes the irrigation with a Janet-Frank syringe and the outflow is conducted by the course of the catheter directly into the glass as shown.

*Author's Modification of the Wolbarst Five-glass Test.*—The manner in which the writer prefers to secure the five glasses of the Wolbarst test is as follows:

1. The patient must come with the bladder as full as possible, by holding his urine for five hours; the instruments must be carefully adjusted and prepared; the irrigation and massage must be thoroughly done and finally judgment and experience must be brought to the diagnosis of all the glasses arranged in a row.

2. A precaution, antecedent and subsequent to the test and never to be omitted, is the administration of any standard and efficient urinary antiseptic for several days. None is better than a solution of five to ten grains each of benzoate of soda and of one of the formaldehyde-producing drugs to a dram of water three or four times a day in a glassful of water about two hours after eating.

3. With the patient flat on his back on a table, with shirts rolled up to his armpits and trousers turned down to his knees and with a Wolbarst basin resting on his thighs, the anterior urethra from the bulb forward is gently massaged after suitable cleansing of the foreskin and meatus.

4. A 12 Fr. soft-rubber catheter is gently passed into the urethra to the bulb and then connected with a 150 c.c. Janet-Frank syringe filled with warm, normal salt solution. The bend of the catheter beyond the meatus droops into a sterile glass resting in the basin so that the irrigation of the urethra is readily carried into the glass.

5. While the left hand supports the penis and catheter from change in their relation to each other and to the glass, the right hand irrigates the anterior urethra with the entire contents of the syringe, 150 c.c.

This step secures Glass I or the anterior urethral glass.

6. The urethra is again gently massaged, from the bulb forward, in order to dislodge clinging discharge not brought away by the first massage and the irrigation. The irrigation is repeated exactly as before.

This step produces Glass II or the control anterior urethral glass.

7. The patient now passes about one inch of urine into a glass, or more if he has had his bladder as full as directed in the preliminary instructions. The contents of the posterior urethra are in this way carried into the specimen along an anterior canal previously cleared by the two irrigations just described.

This step presents Glass III or the posterior urethral glass.

8. Having thus cleansed the urethra as a whole, the character of the urine in the bladder must be known and is secured by passing a small rubber catheter into the bladder and drawing off a part or the whole of the contents.

This step collects Glass IV or the bladder glass.

9. The diagnosis is completed by knowing the condition of the secretion of the prostate and seminal vesicles. If the patient still has considerable urine in his bladder massage of these organs is done at once, or with the catheter still in place the bladder is filled with warm normal salt solution and then the catheter is withdrawn and the massage performed.

This step shows Glass V or the massage glass.

The author's seven-glass test<sup>1</sup> consists in adding the following details to those stated.

10. After the bladder glass is secured, the prostate is very carefully massaged with special reference to not touching either seminal vesicle or their ducts as they pass through the middle of the prostate. This may be done with reasonable and satisfactory success by the experienced finger.

This step presents Glass V or the prostatic glass.

11. The bladder is again filled up to the limit of comfort with normal salt solution whose quantity is noted to, say, 200 c.c., and the right

<sup>1</sup> New York Medical Journal, May 16, 1916.

seminal vesicle is thoroughly massaged, carefully avoiding the prostate, and then the patient evacuates half his bladder contents (100 c.c.).

This step contains Glass VI or the right seminal vesicular glass.

12. The left seminal vesicle is now massaged as its fellow was and its products flushed out with what remains in the bladder, or if the patient has not divided the contents of the bladder well, more fluid must first be run into the bladder or this vesicle left until the next visit for examination.

This step secures Glass VII or the left seminal vesicular glass.

The limitations and cautions of these two tests noted in the introductory paragraph must always be borne in mind. It is well to massage the less diseased seminal vesicle first so that contamination of the contents of the posterior urethra will be limited.

TABLES OF AUTHOR'S SEVEN-GLASS TEST FINDINGS.

POSTERIOR CHRONIC URETHRITIS WITH PROSTATITIS.

	I.	II.	III.	IV.	V.	VI.	VII.
Contents of glasses.	Clear or few shreds (turbid).	Clear	Turbid or large shreds or prostatic elements.	Clear	Turbid, abundant prostatic, detritus.	Clear.	Clear.

POSTERIOR CHRONIC URETHRITIS WITH UNILATERAL SEMINAL VESICULITIS.

	I.	II.	III.	IV.	V.	VI.	VII.
Contents of glasses.	Clear or few shreds (turbid).	Clear.	Turbid or large shreds; vesicular elements.	Clear.	Clear (few elements from prostate and vesicle).	Clear (slightly turbid).	Turbid; many vesicular shreds.

POSTERIOR CHRONIC URETHRITIS WITH BILATERAL SEMINAL VESICULITIS.

	I.	II.	III.	IV.	V.	VI.	VII.
Contents of glasses.	Clear or few shreds (turbid).	Clear.	Turbid; large shreds; vesicular elements.	Clear.	Clear (turbid).	Turbid; many vesicular shreds.	Turbid; many vesicular shreds.

CHRONIC URETHRITIS WITH PROSTATITIS AND UNILATERAL SEMINAL VESICULITIS.

	I.	II.	III.	IV.	V.	VI.	VII.
Contents of glasses.	Clear or few shreds (turbid).	Clear.	Turbid or large shreds.	Clear.	Turbid; abundant prostatic elements (seminal vesicular elements).	Clear (slightly turbid).	Abundant seminal vesicular elements.

POSTERIOR CHRONIC URETHRITIS WITH PROSTATITIS AND BILATERAL SEMINAL VESICULITIS.

	I.	II.	III.	IV.	V.	VI.	VII.
Contents of glasses.	Clear or few shreds (turbid).	Clear.	Turbid or large shreds (prostatic and vesicular elements).	Clear.	Turbid; abundant prostatic elements (seminal vesicular detritus).	Turbid; seminal vesicular elements.	Turbid; seminal vesicular elements.

POSTERIOR CHRONIC URETHRITIS WITH CYSTITIS.

	I.	II.	III.	IV.	V.	VI.	VII.
Contents of glasses.	Clear or few shreds (turbid).	Clear.	Turbid or large shreds.	Turbid; abundant bladder elements.	Clear.	Clear.	Clear.

*Kollmann's test*<sup>1</sup> is also a five-glass test but does not respect the contents of the bladder and is therefore defective in this most important detail. The anterior urethra is irrigated twice, with the patient standing, respectively for Glass I and Glass II and then the patient evacuates his bladder into three glasses. These steps are assumed to distinguish conditions within the anterior and posterior portions of the canal.

*Young's test*<sup>2</sup> consists of seven glasses of which the anterior urethral and control glasses are secured by a double irrigation for each such glass. Of these, the second washings are done with a glass irrigator passed to the bulb of the urethra and directing its current outward. The patient then evacuates into three glasses which are taken to represent the contents of the posterior urethra. The bladder, however, is not catheterized so that the uncertainty of the method duplicates that of the Kollmann test.

**Multiple Glass Tests with Irrigation and with Dye.—General Plan.**—These tests include washing the anterior urethra free of its accumulated discharge after staining it with a dye. Two only are recognized, Kromeyer's and Lohnstein's, and even these are not in frequent use on account of technical difficulties, overrefinement, uncertain deductions and doubtful value.

*Kromeyer's Test*.<sup>3</sup>—The anterior urethra is stained by the injection of 4 or 5 c.c. of 0.1 per cent. of watery solution of methylene blue, retained for several minutes for penetration. The patient next evacuates his urine and all stained products are assumed to belong to the anterior urethra. The fallacy is, however, that the dye may pass by capillary attraction between the two surfaces of the posterior urethra as they lie more or less in contact and thus stain its contents also. Moreover, the bladder contents are not investigated.

*Lohnstein's Test*.<sup>4</sup>—This procedure is much like the foregoing in being a five-glass irrigating method with a dye. The steps are first free irrigation of the anterior urethra into Glasses I and II with 0.5 per cent. watery solution of potassium ferrocyanide until the outflow is clear. The next step is to wash the urethra free of the potassium ferrocyanide solution which is determined by the addition of chloride of iron as the Prussian-blue test of these washings. When this chemical is entirely out of the canal the last step is evacuation of the bladder by the patient into three glasses and the addition of more chloride of iron. Filaments which do not show the Prussian blue are assumed to come from the posterior urethra. The fallacies underlying this test are its undue delicacy, the likelihood that the dye may reach the posterior urethra or fail to enter glands of the anterior urethra, which later give up unstained plugs and finally the absence of proper test of the bladder contents.

<sup>1</sup> Oberländer u. Kollmann: Die chron. Gonorrhoe, 1910, p. 49.

<sup>2</sup> Johns Hopkins Hospital Reports, 1901, ~~vol.~~ 1, 113, 1906.

<sup>3</sup> Quoted by Luys, loc. cit.

<sup>4</sup> Deutsch. med. Wochenschrift, 1893, xix, p. 1072.

**Laboratory Examination of Filaments.**—Diagnosis of the nature of filaments includes the features of preparation of specimen, microscopic features and bacteriological examination. The preparation of the specimen for the laboratory consists by the platinum loop method in snaring a number of filaments, especially some which float and some which sink, with a flamed platinum needle upon a clean and sterile microscopic slide, teasing them out as much as possible, absorbing excess moisture with filter paper and fixing with equal parts of alcohol and ether ready for the stain. By the pipette method it consists in sucking shreds, especially mucous types, into a pipette with as little urine as possible and in the same way spreading them upon the slide. Accompanied by suitable label and brief report of clinical facts and diagnosis the specimens are ready for the laboratory expert. The microscopic features include bacteria whose nature must be proved and many of the following elements: (a) mucus in nearly pure state or mixed with cells and detritus exactly as pus is, (b) fibrin rare alone but mixed with other elements and (c) pus including the other two elements and adding red blood cells, detritus, epithelium from the urethra and from the ducts and acini of glands and finally, (d) spermatozoa dead and entangled in the pus especially in cases of involvement of the seminal vesicles and occasionally of the prostate. The culture of filaments is done exactly in one for both of the two methods stated for slide preparations, with the one change that the shred secured is spread upon the surface of a slant culture adapted for the gonococcus, which as already explained always requires special media and careful protection from chilling in order to have it grow at all or well. It is advisable to take at least three tubes, of which one remains in the office of the urologist as the control tube, and the other two are sent to the pathologist as the laboratory tubes. It is necessary to select shreds which float and shreds which sink for the full examination, so that the author frequently prefers two sets of tubes, one lot containing cultures of the floating filaments and the other set showing cultures of the sinking threads. In this cultural work frequent transplantation is required for a final diagnosis—a detail which rests with the laboratory expert.

#### URINALYSIS.

**Definition.**—For the purpose of diagnosis of gonococcal urethritis urinalysis is of little importance with respect to its usual physical and chemical characters, but of much more value with respect to microscopic and bacteriological features. The organisms sought are the gonococcus and its various associates which in a few obscure cases come away in the urine after having defied other methods of securing specimens, such as have already been elucidated. These methods might be called the clinical examination of the urine. Such investigations are represented by the laboratory specimens described for the seven-glass test of the author and the expressed contents of the glands of Cowper, the prostate gland and the seminal vesicles, which may be found in the

urine as well as in diluting fluid artificially introduced into the bladder—in either case after suitable clinical manipulation of the respective organs.

**Physical and Chemical Characters.**—**Physical Characters.**—Color and odor and specific gravity are of no value in gonococcal diagnostics. Transparency and translucency show or suggest the presence of blood, pus, mucus, fat and chyle. The meaning of clear urine in which shreds are found has already been made clear under the subject of multiple glass tests on page 455.

**Chemical Characters as to Normal Elements.**—Reaction is not of great help and the same may be said as to urea, uric acid, chlorids, phosphates, phosphoric acid, total solids and other common substances searched for in the recognition of renal insufficiency or disease.

**Chemical Characters as to Abnormal Elements** is of greater value as the pus and blood in the urine of severe gonococcal disease are corroborative of the fact of infection. Albumin must be traced as to its source in virtue of the importance of the pyuria which may be its sole cause and of albumin itself as a sign of urinary disorder. The sources may be renal, vesical, prostatic, vesicular and urethral, and are suggested or proved respectively by such other corroborative signs as casts and renal epithelia in kidney involvement, mucus and squamous vesical epithelia in bladder disease, prostatic elements and epithelia in invasion of the prostate, spermatozoa and special epithelia in vesicular complications and finally familiar urethral cells in ordinary urethral infection. Sugar is independent of gonococcal infection except as a rare and peculiar element in those intense infections with systemic complications and severe bodily depreciation. In such cases it becomes an index of the severity rather than the character of the disease. Bile elements, as pigment, acid and salts, are of no value. Hemoglobinuria, consisting of the coloring matter of the blood in solution in the urine in contrast with red cells in suspension, is practically never seen except in wasting malnutrition, such as scurvy and in intense prolonged infections, such as scarlet fever and malaria. It is, therefore, of no reference to gonococcal invasion. Lipuria may confuse the diagnosis in cases complaining of prolonged turbidity of the urine without relief, through the fact that this cloudiness simulates pus. Sedimentation of the urine rapidly clears up this matter, as the globules of fat rise as few, many or even a distinct layer to the top of the specimen glass. Lipuria may be temporary accompaniment of the ingestion of fatty or oily foods or medicines and is often seen in rather minute quantities after the passing of instruments lubricated with oils or after the instillation of oil into the ureters in the removal of calculi without operation, or after the application of oil to the cavity of the bladder. The cause of such presence is at once obvious, as the globules are usually very large and not microscopic, as in true lipuria. Chyluria presents fatty substances in emulsion as distinguished from suspension in lipuria, exactly as seen in the chyle of final digestive stages and of the lymphstream. Microscopic determination is final and its source is not gonococcal,



but such systemic disease as filariasis and accidental introduction into the bloodstream from the injury of marrow bones and of the lymph-stream or nodes or from absorption in extensive abscess processes. Like lipuria it should be borne in mind in patients presenting themselves with the history of unexplained persistent turbidity of the urine.

**Microscopic Characters.**—*Definition.*—Microscopic examination of the urine consists, by definition, in the diagnosis of the sediment and the bacteriology of the urine. Specimens are secured by sedimentation or centrifugation.

Sedimentation consists in allowing the urine to stand until abnormal constituents gravitate to the bottom of the container, by preference with a conical base for concentration of the elements and with suitable protection against contamination from outside sources. The delay incident to sedimentation is recognized as a great disadvantage, because it permits chemical decomposition to be begun in specimens without it or to be increased and continued in urines with it and because through these changes it leads to physical disintegration or change in such factors as red and white blood cells, pus, epithelia, casts, cylindroids and the like and because bacteria already in the urine and inactive or added to it while standing begin to grow and change the fluid totally from the condition in which it was passed. Centrifugation involves placing the urine in the receiving tube of a centrifuge and submitting it to rapid revolutions for a brief period of time, shortest with high-speed electrical apparatus and in ascending order longer in hydraulic and hand machines.

Manifestly the high, uniform, brief or prolonged speed of the electric machine renders it without superior for this and all similar service. After from three to five minutes' centrifuging the smallest possible specimen is sucked from the bottom of the urine tube into a pipette, spread widely and thinly upon a slide, freed of excess urine with blotting paper and covered with a cover-glass. A first-class microscope is essential, adjusted for the examination with the low-power lens for the majority of the elements or with the midpower lens for closer study of doubtful points. High-power lenses are reserved for bacteriological work.

**Elements for Study.**—In the sediment are found red and white blood cells, pus, epithelia, casts and crystals, which vary somewhat in accordance with the chemical reaction. Acid urine is redundant in uric acid, urates, oxalates, hippuric acid and rarely leucin, tyrosin and cystin, while alkaline urine shows triple phosphates, calcium phosphate, basic magnesium phosphate, ammonium urate and calcium carbonate. These crystals are of no importance in gonococcal studies, except that their presence in large quantities may readily irritate the mucosa and prolong the disease and would in such circumstances require dietetic and medicinal relief. The general and special significance of the other elements may be stated as follows:

*Red blood corpuscles* may find their source at any point of the genital and urinary tracts and become important when sufficiently numerous



to be a definite factor in either microscopic or macroscopic examination. Intense gonococcal invasion in acute disease and irritable granulations in or about stricture and similar lesions in chronic infection may be the source of blood cells or bleeding. Fresh specimens of urine show them in the form of their passage, which may be normal or altered according to the site and character of the lesion with or without retention of the extravasated blood. In the normal form they present on the flat a biconcave disk, without nucleus, yellowish singly, slightly reddish in groups or rolls and on edge they appear of dumb-bell form. Older specimens are variously crumpled and crenated. As to significance they occur as a few cells in normal urine and more numerous up to the limit of free hemorrhage in various diseases. When a manifestly important factor their source must be determined without fail, as discussed by the author.<sup>1</sup>

*Pus cells* also may have their origin in any area of the urogenital apparatus and likewise become significant when in sufficient quantity to be a positive factor in either microscopic or macroscopic study. Gonococcal infection is always accompanied by pus cells which are so numerous in acute disease as to make the urine opaque or so few in chronic disease as to occur only in the shreds. On the other hand, pus is the direct result or a by-product in so many lesions of the sexual and urinary apparatus in both sexes that only a bacteriological study will reveal the gonococcus, its allies or other invading organism. Fresh specimens of urine alone portray these cells in their shape on passage, which may be of their ordinary normal forms or altered in chronic disease and retention. Old specimens of urine artificially change the appearance of pus cells, especially during the decomposition of alkaline urine. Such changes in both the urine and the pus may occur within the body and in either circumstance consist in more or less coalescence into various irregular masses after they have previously puffed up and burst. Nuclei are thereafter invisible.

The source of pus cells is chiefly by diapedesis of white blood cells and exfoliation of epithelial cells as parts of destructive processes in any part of the various organs of the system. Regular associates of pus cells are epithelia, casts, mucus and bacteria, among the last for our purpose the most important are the gonococcus, the *Bacillus coli* and other pyogenic organisms. Distinction between epithelial and pus cells is ready by adding Gram's iodine solution to the smear which stains the pus cells a faint yellow and the epithelial cells a deeper yellow in the body and almost a brown in the nucleus, or by adding dilute acetic acid which clears the field and brings out the polynuclei. In form pus cells are on the flat more or less circular or irregular and on edge mere disks or spheres. They are mononuclear or polynuclear with granular bodies both visible in the fresh state but absent through coagulation in older specimens. As to significance, a scattered few pus cells are normal in every urine but may increase from this state to a number so

<sup>1</sup> Pedersen, V. C.: New York Med. Jour., May 3, 1913.

## PLATE II

FIG. 1

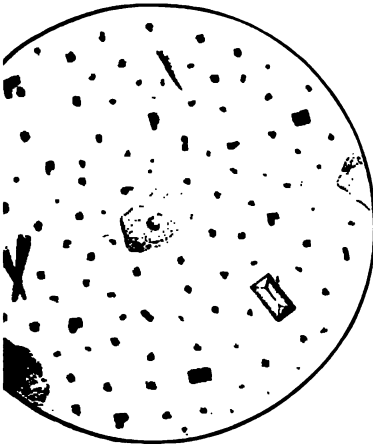


FIG. 2



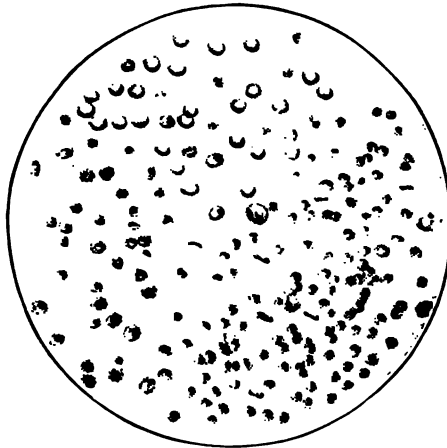
FIG. 3



FIG. 4



FIG. 5



Varieties of Epithelium. (Ultzmann.)

1, 3 and 4. Epithelium from the bladder, the renal pelvis and the ureter.  
Red blood corpuscles.

1

great as to render the urine opaque. Whenever the normal quantity is exceeded the source of the pus must be known, as discussed by the author.<sup>1</sup> Advanced processes show the pus cells in casts and clumps usually from the upper urinary organs, while scattered cells may come from any point whatever.

Scattered epithelial cells; numerous pus cells singly and gathered into masses.

*Epithelia.*—Fresh specimens are again to be preferred although decomposition alters epithelia less than most of the other constituents in the urine. As to source, these cells may come from any part from the deepest excretory elements of the kidney to the external limits of the urinary canal and sexual organs, from which especially in the female many cells are washed away during micturition. This fact renders the catheterization of both sexes in many circumstances the sole means of securing a specimen assuredly from the bladder only. Epithelia may also come from any layer, of which there are commonly three: superficial, middle and deep. As a rule, the superficial cells show the type predominating while the middle and deeper layers are the transitional forms. In the urogenital tract the epithelial cells are often similar in form, such as the cuboidal or round cells from the posterior urethra, ureters and pelves which vary slightly in size, granular appearance of the cell bodies and size of the nuclei. In form, the common varieties are flat or squamous, cuboidal or round, cylindrical or caudate or spindle, and finally ciliated. In general distribution through the lower urinary tract the flat pavement cell prevails and is largest in the vagina and vulva and smaller in the male urethra throughout the fossa navicularis and neck of the bladder and a mean in the bladder itself. Cuboidal or round cells appear at many points of the sexual and urinary organs, especially in the deeper layers, where they occur in the urinary organs in the urethra, bladder, ureters and pelves and some portions of the tubules of the kidneys, and in the sexual organs in the prostate and vagina. Round cells in the strict sense are probably cuboidal cells altered after having left their sites. Cylindrical or caudate or spindle cells have the same distribution as the foregoing and are, as a rule, from the deeper layers as the first stage of development. They are, therefore, found in the urethra, bladder, ureter and kidneys along the urinary passages and in the prostate and seminal vesicles in the sexual glands. Some authorities state that cilia are on the cells of the seminal vesicles. The minute distinctions with the microscope may so easily err that the source of epithelia must be judged chiefly from other signs in the urine rather than from mere size and form. In significance, epithelia vary as to their source and condition and the latter in accordance with the decomposition of the urine within or without the body and the bacteria present. A few words are essential concerning the various kinds of epithelia from the meatus to the kidneys in the main portions of the tract: urethra, bladder, ureters and kidneys.

<sup>1</sup> Pedersen, V. C.: New York Med. Jour., December 13, 1913.

which are technically known as casts. As to significance, casts are known to be the signs of medical and surgical lesions of one or both kidneys, and are so common in bilateral medical renal affections that they have been most widely studied in this connection and have subconsciously come, therefore, to be regarded as accompaniments chiefly of such conditions, more or less indirectly to the exclusion of surgical involvements of these organs. This is a serious error, because all surgical renal disease is more or less directly accompanied by inflammation with or without infection, which carries with it immediately the same signs as are seen in medical developments and summed up in alterations of physical and chemical characters and presence of albumin, casts, pus, blood, epithelia, crystals, detritus, changed urea, excretion, changed dye-test signs and the like in the urine. Inasmuch as many of these signs may appear from any point of the urinary tract, casts become a very important corroborative or suggestive sign of the renal source of these abnormal elements and therefore assume as much weight in surgery as in medicine.

In the recognition of gonococcal urethritis casts are of value in showing the actual source of pus in those patients who have it in the urinary organs above the outlet of the bladder, as distinguished from the sexual organs and as indicated by the seven-glass test of the author. Their presence will at once show whether the kidneys are involved in the process independently of the bladder or combined with it. In strictly urethral conditions, therefore, casts must be considered as valid indicators of the origin of pus, along with their usual associates.

**Varieties.**—Varieties in their ascending order of clinical interpretation as a basis, are: (1) hyaline, (2) granular, finely or coarsely, (3) epithelial and (4) waxy casts. Special forms, as determined by the addition to the hyaline basis of each of the elements suggested by the names applied to the casts are: (1) pus, (2) blood, (3) fatty, (4) crystals and detritus and (5) bacteria. Organisms in their nature cannot make up a whole cast but are sometimes seen in pus and epithelial specimens. In their form, casts are cylindrical, with more or less uniform or broken borders, with rather straight, sinuous, tortuous or almost spiral bodies, with both ends rounded or one end ragged, with length to extend half-way across the field or so short as to be very numerous in one field and with density so slight as to require much decreased illumination for visibility of hyaline casts or so great as to permit study only by reflected light in many pus and blood casts. All grades of density between these limits are seen.

**Hyaline Casts (Gelatin or Vitreous Casts).**—These are the earliest in occurrence and the commonest in health and, therefore, the least clinically important casts when seen alone. In size hyaline casts are the largest, so that one may extend far across the field, and in diameter are very small or large according to the tubule from which they come. In outline their borders may be fairly straight and uniform or sinuous and twisted, also according to their tubules of coagulation. Both ends of hyaline casts are usually rounded, on bodies which may be of glassy

## PLATE III

FIG. 1



FIG. 2

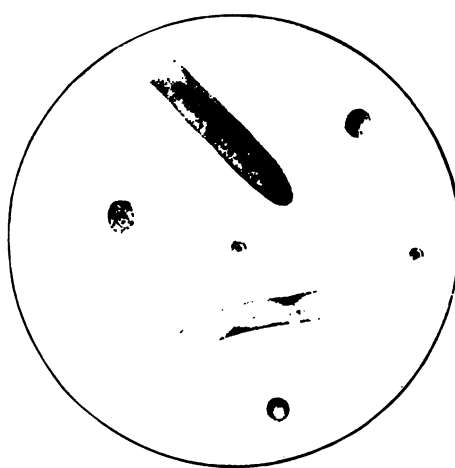


FIG. 3

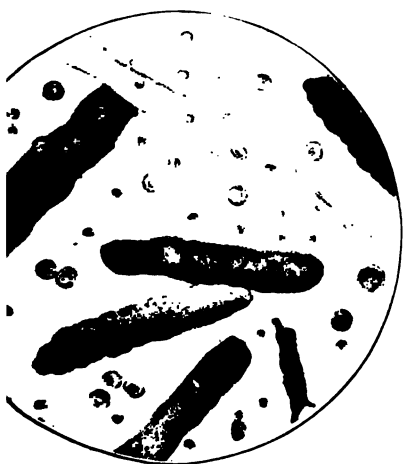
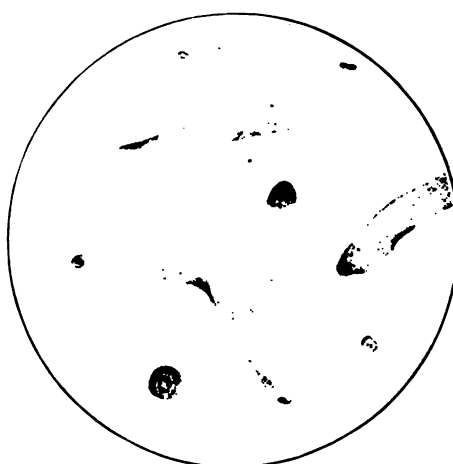


FIG. 4



### Urinary Analysis. (Ultzmann.)

1. Epithelial casts seen in acute desquamative nephritis.
- 2 and 4. Hyaline casts from renal congestion and chronic nephritis.
3. Coarse granular casts from acute nephritis, with some blood corpuscles.





clearness or very finely granular or delicately striated. They are the most difficult of all casts to see in the field and always require greatly subdued light. As to significance, a few hyaline casts are always seen in health, dependent on slight dietetic error, active or violent exercise and factors adding to blood-pressure in the young and in later years they are a common element in the urine without renal lesion. The absence or presence of albumin and other kidney elements is the dividing line between such as are without or with danger signs. In profound disease one therefore sees along with them any or all other kinds of casts, epithelia, albumin and sometimes pus and blood according to circumstances. Large numbers of hyaline casts in apparent health may, therefore, suggest the wisdom of minute search for their cause and of observation of the patient at short intervals, every few weeks, for other signs of kidney breakdown, because many such casts are often forerunners of serious signs.

**Granular Casts.**—Granular casts may be fine or coarse, according to the characters of the granules seen within the bodies of the casts. In nature they are probably hyaline casts whose masses have been changed by coagulation of the albuminous material, more densely at certain points rather than uniformly or by precipitation of unknown matter in finely subdivided state. A few of these granular casts seem to show small fat globules and have the remnants of epithelia attached to or imbedded within them, of which the nuclei alone remain. As to significance, granular casts represent the next development of nephritis and are very numerous indeed in all varieties, sizes and forms in marked cases and may be said to appear in health in scattered specimens.

In size and diameter they are usually smaller than hyaline casts, possibly because they are somewhat more apt to come from the upper tubules.

**Epithelial Casts.**—Epithelial casts may be, first, hyaline casts to whose surface a few epithelia have been glued or so many as to make a complete cover, or, second, true epithelial plugs either more or less solid or having an irregular lumen. In size epithelial casts are among the smallest, as a rule, as they come from the finer tubules and their surfaces and outlines are essentially irregular and ends broken. Along with them the urine always shows scattered epithelia, many other forms of cast and other signs of kidney involvement. The desquamation present invariably means severe inflammation and blood cells and even blood casts may be associates. Epithelial casts are not seen in health.

**Waxy Casts.**—Waxy casts are shown in Plate IV, Fig. 4, and are also called amyloid casts, through their origin in amyloid degeneration of the kidney. In form they are usually of irregular or uncommonly regular outline, with ends broken and ragged, with color a peculiar whitish-yellow waxiness or a glassy brightness. They are without transparency and with moderate translucency, but with high refraction of light. Their density is commonly not uniform. As to significance, waxy casts are highest in the scale of importance and represent advance lesions.

**Pus Casts.**—Pus casts consist of formed masses of pus cells, and have much the same significance and associates as pus in large quantities in the urine, as fully discussed under this subject.

**Blood Casts.**—Blood casts have already been alluded to as developments and associates of epithelial casts and are made of massed blood cells. They are very commonly accompanied by large numbers of scattered blood cells and nearly every other possible element of renal disease.

**Fatty Casts.**—Fatty casts are more commonly those in which fat globules after error in diet, injury of the marrow of bones and the inhibition of fatty medicines become attached to commoner varieties of cast.

**Bacterial Casts.**—Bacterial casts are not common because bacteria in their nature could hardly be sufficiently numerous of themselves to form true plugs of the tubules. But they may be so numerous in the medium and so freely within epithelial and pus casts on staining as to warrant this term.

**Crystalline Casts.**—Crystalline casts are less common than other kinds, and consist of crystalline or amorphous plugs of the various urinary salts. In infancy before the kidneys become accustomed to their new surroundings such casts of uric acid and urates are not rare.

**False Casts.**—False casts are mucous developments rather as strings than as true plugs or molds and originate either in kidney or ureter by unhealthy secretion rather than by coagulation of mucus. In form they bear a rude resemblance to large casts, with shaggy, stringy outlines and ends without tapering or rounding. The bodies show all the characters of mucus but may be slightly granular and may or may not clear on the addition of dilute acetic acid. Cylindroids is another name applied to them and they may appear alone and without significance in health but in disease invariably have any and all of the foregoing associates.

**Crystalline and Amorphous Deposit.—Significance.**—In health all urine shows a certain amount of crystalline deposit after centrifugation, which depends much on diet and temporary conditions of metabolism, but in disease it represents permanent defect of metabolism so that the urine becomes saturated with one or the other or several salts. These precipitate within the body at any point of the urinary system, chiefly as the result of infection of the urinary passages with secondary decomposition of the urine in the kidney, its pelvis, ureter or bladder or are very rapidly cast down during the slightest decomposition on standing. This fact shows the importance of fresh specimens in the determination of the meaning of these crystals. Decomposition and ammoniacal fermentation of normal urine on standing in a specimen glass will result in almost all the crystals seen in alkaline urine, so that acid urines should be examined at once to anticipate such misleading change and alkaline urines should not be allowed to stand because of misleading increase of their constituents as passed.

## PLATE IV

FIG. 1



FIG. 2

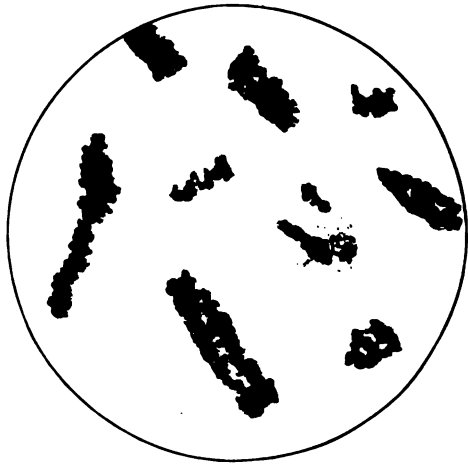
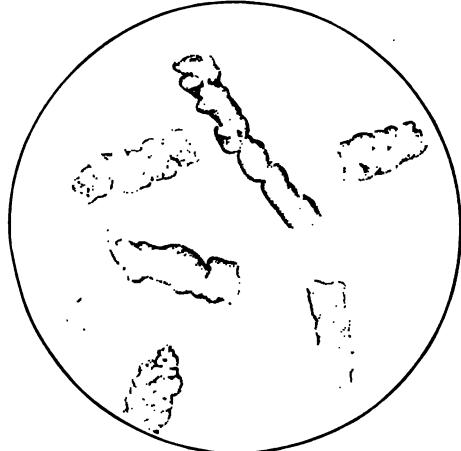


FIG. 3



FIG. 4



### Urinary Analysis. (Ultzmann.)

1 and 2. Hyaline casts. In Fig. 2 they are covered with crystals of urate ionium.

3 and 4. Fine granular and waxy casts. Fig. 3 is from a case of acute chronic Bright's disease. Fig. 4 is from a case of amyloid disease.



## PLATE V

FIG. 1

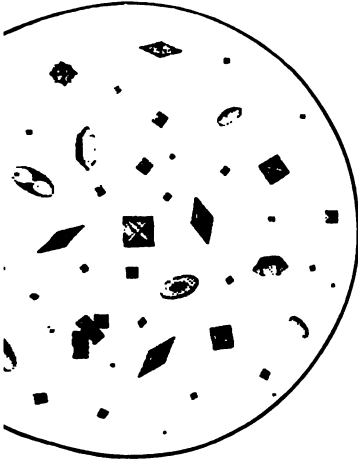


FIG. 2

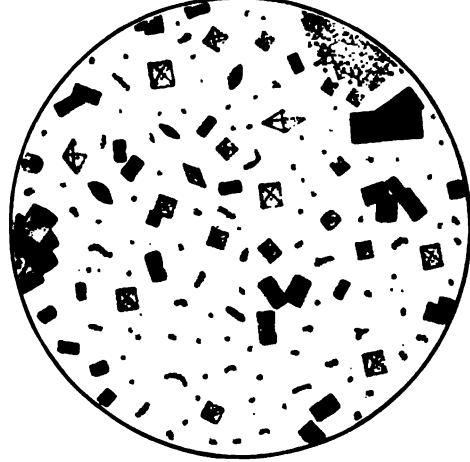


FIG. 3

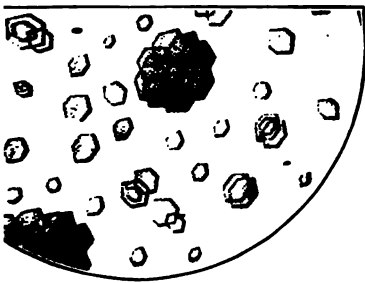


FIG. 4



### Urinary Analysis. (Uitzmann.)

Figs. 1 and 2. Crystals of oxalate of lime.

Fig. 3. Crystals of cystin.

Fig. 4. Crystals of leucin and tyrosin.



In gonococcal conditions in which a multiple glass test has shown the pus to come from the upper urinary organs the presence of crystals and amorphous deposit will serve only to illustrate processes which may there be the source of the pus. If supplemented by bacteriology and a study of other elements present, a distinction is always possible.

**Varieties.**—As previously stated, crystals vary with the reaction of the urine so that acid urines in health show a few and in disease many crystals of uric acid, urates, and oxalates, as the most important sediment and as the rare and less significant crystals hippuric acid, leucin, tyrosin and cystin. Alkaline urine does not occur in health and shows the following decomposition products, a few of which may be seen in neutral urine of health or normal urine rendered temporarily alkaline by the administration of suitable medicines. These crystals are triple phosphates, calcium phosphate, basic magnesium phosphate, ammonium urate and calcium carbonate. Of these the last is of least importance.

**Uric Acid Crystals.**—Uric acid crystals occur in acid urine, usually as a reddish deposit to the naked eye if abundant and are caused by over-indulgence in nitrogenous food or by nitrogenous waste as in violent exercise or prolonged labor. Their size makes them among the largest urinary crystals. Their form is polymorphous and variously polyhedral, stellate and rhomboid, as shown in the foregoing plate. Various form-groupings render them beautiful crystals having in the field a yellow or yellowish-red or colorless aspect and to the naked eye a reddish hue. They are soluble in alkali and heat and as to significance are recognized as common in health in small numbers but in large quantities as suggesting the uric acid diathesis, faulty metabolism or renal stone. The latter detail must be corroborated by other signs of stone, described in the sections dealing with lithiasis of kidneys, ureters and bladder, in Chapters XIV, XV and XVI.

**Amorphous Urates (Brick Dust Deposit)** have the same occurrence, cause and significance as uric acid and the form of small dustlike granules of yellow to red color in the field and of definite red color to the naked eye in the specimen glass. The addition of alkali or the application of heat to the specimen dissolves them. Plate VI portrays their general appearance under the microscope.

**Calcium Oxalate Crystals** occur in scattered crystals in acid urine under whose products it should be classed, but as they are soluble in the addition of acid they may not precipitate until the urine becomes neutral or faintly alkaline in the very early decomposition stages. Alkalies do not dissolve them so that they persist in ammoniacal urine (Pellew).<sup>1</sup> Their cause seems to be fruit and vegetable diet abundant in oxalic acid, such as strawberries, asparagus, rhubarb and tomatoes, also nervous instability, faulty nutrition and indifferent general health. Their size is smaller than uric acid although they are large and small. Their form is twofold, most commonly octahedral,

<sup>1</sup> *Manual of Practical Medical and Physiological Chemistry*, 1893, p. 271.



of long or short planes, and less commonly hour-glass or dumb-bell, resembling a very large blood cell on edge. The color is white, bright, reflecting and refracting light and their solubility is in acid and not alkaline media. Their significance is in health recent and abundant vegetable or fruit diet or in disease faulty digestion and assimilation or oxalate diathesis with lithiasis, which must be sustained by other signs, such as mucus, blood, pus and large numbers of these crystals. In the treatment of gonococcal disease, of which part is always a neutralization of the urine, these crystals must be looked for and if possible eliminated, otherwise their sharp corners and edges may readily irritate the mucosa and prolong the symptoms.

**Ammoniomagnesium Phosphate (Triple Phosphate) Crystals** occur in alkaline urine, caused by chemical change set up by infection, inflammation and ulceration at any point of the kidneys, ureters or bladder and very commonly in decomposing urine of prostatic obstruction. In size these crystals are rather large, about equal to those of uric acid and in form polyhedral, forming the so-called "coffin-lid" crystals as the commonest type and the leaf crystals as the uncommon variety. The color is a brilliant white reflecting and refracting light. They dissolve on the addition of acid to the urine. Their significance is in fresh specimens, decomposition of the urine and almost always the infection and suppuration which accompany it. In very large numbers verified by all other means of research they suggest lithiasis and are very common in cystitis and pyelitis. In older specimens they prove decomposition of the urine before the examination.

**Amorphous Calcium Phosphate** is commonly known as amorphous phosphate and occurs in alkaline or neutral urine almost invariably associated with triple phosphate. The cause is the same as that of the latter crystals, but they are much more commonly the product of conditions of nervous ill health and malnutrition, so that some patients will void a urine so rich in them as to simulate thin semifluid mortar. The size and form, indicated by the term *amorphous*, are that of faintly visible dust, which dissolves on the addition of acid and heating of the urine. As to significance they show a vegetable, fish or sea food diet, the ingestion of alkaline waters and drugs, defective assimilation, nervous disturbance and, like triple phosphate, infection and decomposition of the urine within the body or specimen container. In gonococcal affections the use of alkalis to neutralize the urine and the mental unrest of the patient often produce large quantities of amorphous calcium phosphate which is difficult to distinguish from pus, especially in the later periods of the disease, when free pus in the urethra is insufficient to render the urine turbid. It is well therefore to add acid to the urine at frequent intervals in order to remove these phosphates, leaving the pus behind for study.

**Ammonium Urate Crystals** occur in alkaline urine and are always caused by decomposition as a disease process within the organs or as an artifact within the laboratory. Their size is small and their form either smooth globules or spined globules, both singly or in pairs or

## PLATE VI

FIG. 1

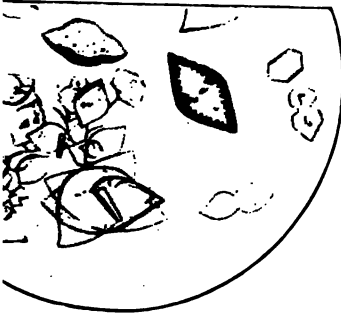


FIG. 2



FIG. 3



FIG. 4

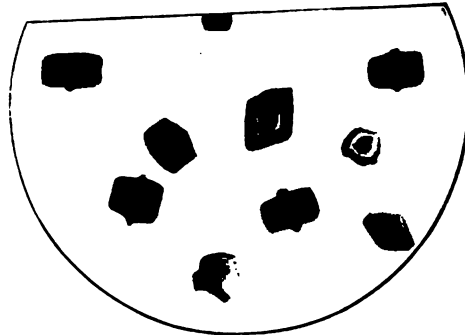


FIG. 5



FIG. 6



### Urinary Analysis. (Ultzmann.)

1, 2, 3 and 4. Different forms of crystals of uric acid.

5. Crystals of urate of ammonium.

6. Crystals of urate of ammonium and triple phosphate crystals.



# PLATE VII

FIG. 1

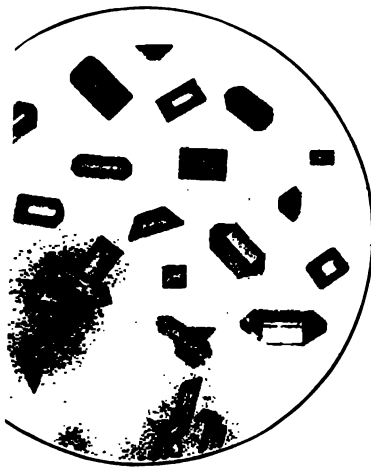


FIG. 2



FIG. 3



FIG. 4

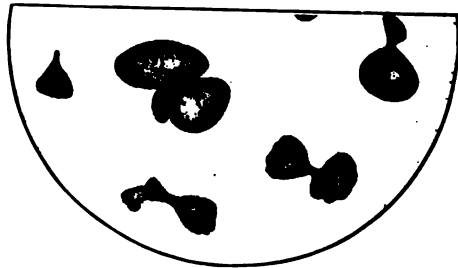
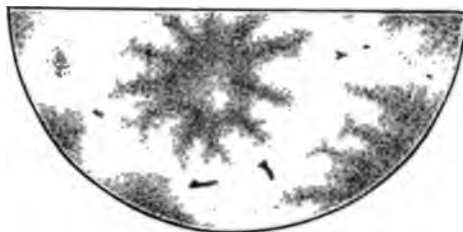


FIG. 5



## Urinary Analysis. (Ultzmann.)

- 1 and 2. Crystals of the triple phosphates. Fig. 1 is the common form.  
 3. Crystals of phosphate of lime.  
 4. Crystals of urate of sodium.  
 5. Amorphous urate of sodium.



## PLATE VIII

FIG. 1

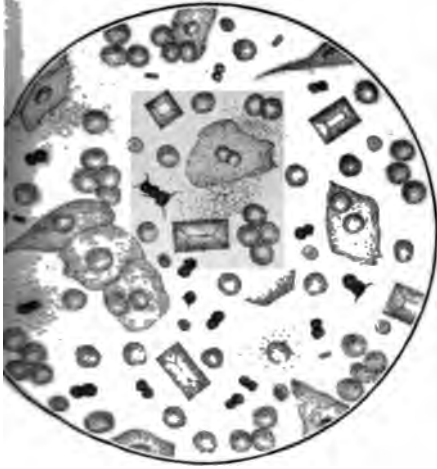


FIG. 2

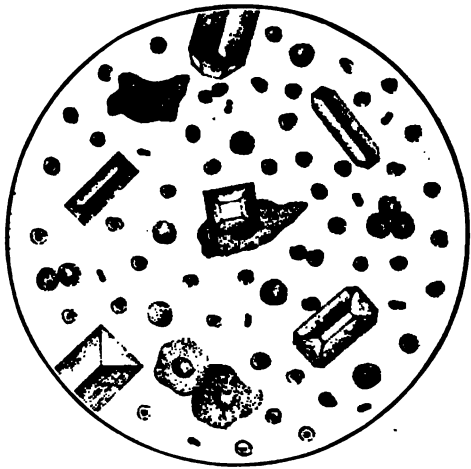


FIG. 3

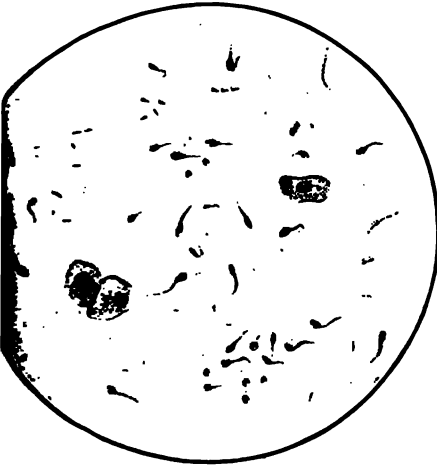
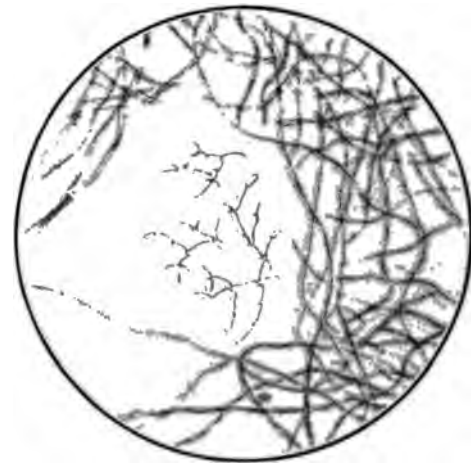


FIG. 4



### Urinary Analysis. (Ultzmann.)

Figs. 1 and 2. Sediment of chronic cystitis. Fig. 2. Moderate bleeding.  
Figs. 3 and 4. Spermatozoa and the yeast fungus.

in septic processes with blue pus, (8) *Bacillus typhosus* in typhoid and paratyphoid cases in nearly 50 per cent. of the total patients, (9) *Bacillus anthracis* in anthrax, (10) *Bacillus mallei* in glanders and (11) *Bacillus tuberculosis* in many forms of surgical and occasionally in medical tuberculosis.

This partial list illustrates the importance in gonococcal or suspected gonococcal infections of securing specimens properly and of having them thoroughly searched for the source of pus in obscure cases. Of the organisms stated, the most important, because more common, are the *Bacillus tuberculosis*, *Bacillus coli communis* and the pyogenic staphylococci and streptococci and the less important, because more rare, are the *Bacillus pyocyaneus*, *Bacillus typhosus*, *Bacillus anthracis* and *Bacillus mallei*.

**Parasites.**—Parasites, other than the fission-fungi or bacteria, may also infest the urine and are likewise either nonpathogenic or pathogenic.

*Nonpathogenic Parasites.*—These are usually the moulds and yeast. The latter is present in all normal urine and very abundant in diabetic urine, and plays an important part in its cystitis and is the essential of the fermentation test for sugar. Infusoria belong in this group of parasites occur usually in old alkaline specimens and are said to comprise chiefly the amœbæ and the *Trichomonas vaginalis* (von Jaksch<sup>1</sup>).

*Pathogenic Parasites.*—Pathogenic parasites include chiefly the worms and their eggs and are illustrated by *Distoma hematobium* and *Filaria sanguinis hominis*, both characterized chiefly by tropical origin and hematuria, and echinococcus, revealed by hooklets, eggs or membrane and frequent in some countries but uncommon in the United States. It seems to arise from the rupture of cysts from points outside the urinary organs and canals into them and is then associated with corresponding symptoms. If occurring within the kidneys or bladder hematuria and pyuria are invariable accompaniments along with the hooklets, membrane and sometimes eggs. *Ascarides* are not seen in the urine unless there is a fistula into the bowel from the bladder or urethra.

In dealing with obscure or suspected gonococcal lesions parasites must be borne in mind in the same way as the bacteria, as just stated, and their possible presence warrants a careful analysis in all such cases.

**Special Bacteria,** as they occur in the urine, are for our purposes in the order of their occurrence the gonococcus, *Bacillus coli communis*, *Streptococcus pyogenes*, *Staphylococcus pyogenes*, and *Bacillus tuberculosis*.

*Gonococcus.*—*Gonococcus* occurs very frequently although less frequently than the *Bacillus coli communis*, and has its source in acute or chronic urethritis or its more important complications, such as prostatitis, vesiculitis and funiculitis. It may be washed into a specimen glass from the urethra by the urinary stream or be found in the

<sup>1</sup> Tr. by Cagney, 4th ed., 1897, p. 271.



bladder by direct transit in continuity or by incidental infection through irrigation and instrumentation. Gonococcal cystitis is apt to be most severe in the trigonum as a trigonitis from which it rarely extends to the bladder as a whole until and unless other pyogenic organisms are associated with it, particularly the *Bacillus coli communis*. Trigonitis in women is very common and more readily studied than in men. The gonococcus may be found in the kidney, its pelvis and ureter rarely as an ascending infection from a cystitis and more commonly as a hematogenous development from penetration of the organisms into the bloodstream, from chronic foci in the seminal vesicles and the prostate. In such cases arthritis is not uncommonly present and the organism is almost invariably associated with other pyogenic organisms, although occasionally pure cultures of the gonococcus are found in these manifestations.

*Bacillus Coli Communis* is the most common organism in the urine of the group mentioned and has its origin in the large variety within the lower intestine known as the colon group. It is a normal inhabitant and benefactor within the large bowel in health but may in disease become the source of vicious purulent processes of hematogenous origin, exemplified particularly by appendicitis, cholecystitis, pyelonephritis and cystitis. It is probable that the colon bacillus normally passes through the urinary organs without exciting lesions. Bassler<sup>1</sup> found it present in 9 per cent. of 191 fresh urines from patients without urogenital symptoms. It undoubtedly reaches its own foci of disease in the urinary organ from the bloodstream or the lymphstream or both and is almost always associated with other important organisms, especially the *Bacillus tuberculosis*, *Staphylococcus pyogenes*, *Streptococcus pyogenes*, *Streptococcus pyocyaneus* and the gonococcus. It is the originator of acute and chronic alkaline cystitis even in the absence of the other organisms just stated, such as the *Bacillus tuberculosis* and the pyogenic group. Tuberculosis may invade the urinary organs usually with early bleeding and without much pus being present until the colon bacillus is added to the process, when the purulence immediately becomes active and excessive, at any and all points of the system—kidneys, ureters or bladder—by profound compromise of the local resistance and with the result of nephritis, pyelonephritis, ureteritis and cystitis. Increased hematuria by the *Bacillus tuberculosis* is usually the next step in these cases. As a common ally of the gonococcus it becomes of importance to the student of gonococcal infections. Turbidity of the urine is often caused by numberless colon bacilli which may filter through the kidneys, in the opinion of many, without causing disease, but this fact is not accepted universally.

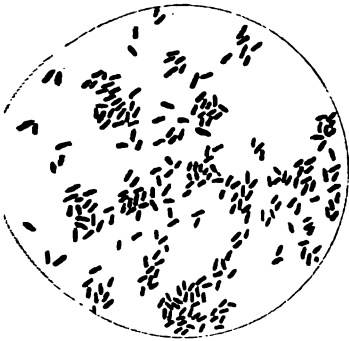
**Pyogenic Organisms.**—*Streptococci* and *Staphylococci*.—The pus-forming cocci are second in frequency in the urine only after the colon bacillus, if the gonococcus is not included. Their sources are usually lesions of the mucous membranes for the streptococcus and lesions of

<sup>1</sup> Med. Rec., July 6, 1912.

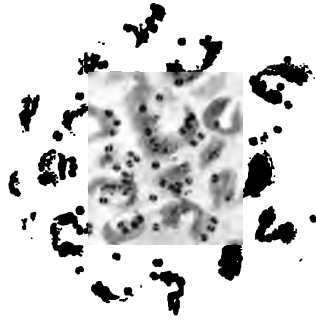
the skin for the staphylococcus. Their entrance into the urine is much like that of the gonococcus from the urethra by being washed away in the urinary stream and from the bladder by direct inoculation through the traumatism of instruments and other means and by lowered local and general resistance, as seen in anemia and tuberculosis and generally unhygienic conditions. Hematogenous entrance of these germs into the urinary system is an undoubted fact, as the expression of many septic processes and as establishment of septic infarct and other abscess of the kidneys. Any point whatever of the canal may be invaded from the meatus upward—urethra, bladder, ureters and kidneys. In the urethra they are local in their manifestations and likewise in the bladder as nongonococcal urethritis and cystitis, although in the latter the inflammation is apt to be universal in distinction from the trigonitis of gonococcal invasion. In the complications of gonococcal disease, especially when abscesses are present in the prostate, seminal vesicles and testicles the streptococcus and staphylococcus are apt to be present. In the kidney the entrance of the germ is usually hematogenous from a focus elsewhere within or without the urogenital tract and less commonly the entrance is by direct ascent from the bladder along the ureter. The character of the infection is always severe, no matter what part of the urogenital tract is attacked and these organisms are often associated with others as well as with each other. It is rather well established and widely accepted that rheumatism occurring during gonococcal manifestations is rarely if ever due to the gonococcus alone, but most commonly to the streptococcus associated with it. Recovery of these organisms from the urine rests on the examinations of urethral smears and on sedimentation and centrifugation of the urine under strict antiseptic precautions and finally by culture. Animal inoculation is of value in determining the virulence.

*Bacillus Tuberculosis.*—*Bacillus tuberculosis* is in occurrence less frequent than many of the others but in importance of equal rank. Its source is practically always hematogenous and lymphogenous or both and hardly ever by direct inoculation. As in the respiratory system, so in the urogenital system, any organ or any part thereof may be involved in almost any degree of lesion; thus are invaded, as examples, the kidneys, their pelves, ureters, bladder, prostate, testicles, and seminal vesicles—any and all, as primary and secondary foci. In primary lesions of the prostate, testicles and seminal vesicles the bacilli enter the urine by direct discharge of these glands into the urethra, whereas in the urinary organs the bacilli probably pass through the kidneys with the urine. In the bladder tubercles may break down, ulcerate and thus discharge their bacilli. In the kidney any part of the organ may be involved—the parenchyma and pelvis or both in few or many, small or large, slowly or rapidly destructive lesions. As long as the excretory function at the focus is maintained bacilli are thrown into the urine, but often when the walling off process is complete or when excretion has been destroyed, the bacilli

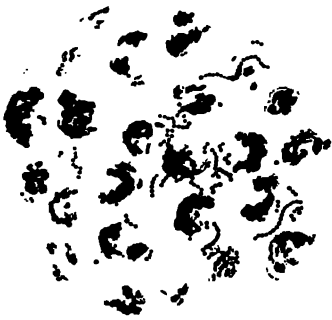
# PLATE IX



**Bacillus Coli Communis.**



**Gonococcus.**



**Streptococcus Pyogenes.**



**Bacillus Tuberculosis.**



**Pneumococcus.**



**Staphylococcus.**

Magnified 1000 diameters

s Commonly Found in Chronic Urethritis with the Exception  
of the Bacillus Tuberculosis, which is Rare. (Dudley.)



are absent or very scanty, even when the disease has involved much of the kidney. The detection of the *Bacillus tuberculosis* in the urine depends on careful collection of one or many twenty-four-hour specimens, under antiseptic precautions, in a conical jar whose sediment is then carefully removed, centrifuged and examined with the microscope. Animal inoculation is the chief means of establishing the identity of the germ found, although various differential stains and the trained eye are usually successful through morphology alone. The *Bacillus tuberculosis* except in staining qualities and cultural characteristics and animal infection is closely resembled by the smegma bacillus of the prepuce of both men and women. Further refinements in this question belong to a work on bacteriology.

**Gonococci in the Urine.**—As a means of verifying other tests and of making the diagnosis when it is difficult in some individuals, especially women, to obtain specimens, importance is attached to analysis of the urine for the gonococcus. It sometimes permits the diagnosis of obscure infection in the prostate and seminal vesicle after free discharge has stopped and the patient seems to be well. Its limitations reside in the characteristics of the urine and the gonococcus.

In the first place the urine rapidly decomposes and thereby makes this diagnosis difficult or impossible. A fresh specimen of urine is essential. The first urine passed in the morning is the best because the exudate containing pus and organisms collects during the night and washes out from the urethra with the first evacuation. Stripping the canal as far as possible from end to end before the patient voids will loosen shreds and slugs. The urine should be collected in a sterile conical glass and allowed to sediment by gravitation. The accumulation of the gravitated pus and detritus is pipetted and spread upon the slide. The urine may be centrifuged at high speed for several minutes and then pipetted and the specimen prepared for the microscope. If the deposit is excessive it may be diluted with normal salt solution and again centrifuged or gravitated. After such dilution the examination is much more easy and accurate.

In the second place the gonococcus renders its discovery in the urine difficult because in nearly cured cases the other normal flora of the urethra begin to predominate and the gonococcus is very scattered and infrequent. For this reason many control specimens are required, especially in the female. A single negative investigation is useless. The Gram stain is the one security against error and should always be made together with study of the morphology and grouping of the organisms in and about the pus cells. Culture when possible is the best of all diagnosis. It should always be attempted if the urine is fresh and collected under antiseptic precautions. Of the other organisms in the urine the cocci are the most important for consideration. Most of them are gram-positive and a few are gram-negative. The majority of these cocci are very rare in the urinary passages, especially in the male. The reader is referred to works on bacteriology for the list and distinctions of these bacteria. The *Micrococcus meningitidis*

and *Micrococcus catarrhalis* are important. Of these two the former is very rare indeed in the urinary organs and is found chiefly in the upper air passages and in the cerebrospinal spaces in cases of meningitis. The *Micrococcus catarrhalis* is more important and very common in the urethra of men and women. In its early life-cycle it is gram-negative and only later gram-positive. In morphology it resembles the gonococcus more than any other coccus does. Culture alone is the means of diagnosis. This coccus usually grows freely at room temperature. Further discussion of this organism is in the clinical pages of this work under the subject of Nongonococcal Urethritis. Bumm,<sup>1</sup> in his original work, contributed largely to our knowledge of the cultural peculiarities of the gonococcus.

**Gonococcus in Dried Pus.**—The demonstration of the gonococcus in stains and crusts on clothing and dressings is possible but very difficult. The medicolegal aspects of this detail comprise its importance as to results and technical performance. The diagnostic requirements of the Gram stain and culture at once show its limitations, because the gonococci must be in the pus cells and the white blood cells and possess the correct form, size, grouping and staining, as already shown under this subject on page 26. Culture is often doomed to failure because the gonococcus is not resistant and dies early as it dries, so that in very old stains on clothing culture is not possible. Other organisms in the crust may easily deceive the observer. In a girl who had been repeatedly ravished by one man micrococci were found by Wachholz and Nowak.<sup>2</sup> These resembled the gonococcus very closely, but both the man and the woman did not have the disease. The error arose, as it might in any similar case, from the fact that not only the micrococci appeared like the gonococcus but also the latter changes its character in these old specimens.

There are two general methods of searching such stains, those of Kratter and of Heger-Gilbert.

Kratter<sup>3</sup> scraped dried pus from the clothing, soaked it in water for a brief period, squeezed threads and shreds free of the pus and made the usual smear preparation for stain and examination. Haberd,<sup>4</sup> in experimenting with this method, proved that success is directly proportional to the amount of pus and the cleanliness of the linen; great difficulties occur in thin stains and soiled linen, but greater certainty of diagnosis and ease of technic in thick stains and clean linen. These principles are self-evident because the larger the amount of pus and the less the contamination or chance thereof the better the results of investigation.

Heger-Gilbert<sup>5</sup> demonstrated the gonococcus in a two-year-old stain. The method is to cut a pad of linen or blotting paper to fit a

<sup>1</sup> Der Mikroorganismen gonorrhoeischer Schleimhaut-Erkrankungen, Wiesbaden, 1885.

<sup>2</sup> Viertelj. f. gerichtl. Med., 1895, 3 F., ix, 75.

<sup>3</sup> Berl. klin. Wchnschr., 1890, xxvii, 960.

<sup>4</sup> Viertelj. f. klin. Med., 1894, 3 F., viii, Suppl. Heft, p. 227.

<sup>5</sup> Jour. méd. de Bruxelles, 1908, xiii, 524.

watch-glass and to moisten it with isotonic salt solution, alkalinized with sodium bicarbonate. The stain is cut to size and placed on this pad and covered. After from one to five hours the drops underneath are sucked up and transferred to the slide, smeared, dried and stained. This is an accurate method, but concerns morphology only.

### ORRHODIAGNOSIS OR SERUMDIAGNOSIS.

**Orrhodiagnosis.**—**Definition.**—Serumdiagnosis may be regarded as recognition of disease through the means of bacterial products, of which serum was the first and still remains the chief, although it by no means includes all the products. When injected into the animal in suspected disease, various reactions occur which are the basis of the diagnosis. Serumtherapy may be described as the treatment of disease, similarly by injection of bacterial products, of which serum is again the most typical. Such treatment rests on protection of the patient, steadily augmented by graduated and ascending doses of the product.

**Basis.**—In man, as in all other mammals during disease, the blood produces protective elements, specific for each disease, and known as antibodies. These may be subdivided into two kinds in accordance with their action on the organisms themselves and with their influence on the products of the organisms.

#### Varieties of Antibody.—

1. Having action on the organisms themselves:
  - (a) Agglutins, which cause the germs to “clump” or, as the term indicates, to agglutinate in the field of the microscope upon their addition to the specimen.
  - (b) Bacteriolysins, which dissolve or destroy the organisms directly.
  - (c) Opsonins or bacteriotropins, which alter the constitution of the organisms so that the blood readily disposes of them by phagocytosis.
  - (d) Precipitins, which as the term suggests, precipitate the germs in laboratory preparations.
2. Having influence on the products of the organisms:
  - (a) Antitoxins, which, as the term shows, neutralize or otherwise influence the toxin favorably for the individual infected.

**Pfeiffer's Phenomenon.**—In 1896 Richard Pfeiffer<sup>1</sup> discovered the fact that when the peritoneal fluid of a guinea-pig immunized to the cholera bacillus possesses the power of causing the destruction and disappearance of living cholera bacillus (bacteriolysis) and that the blood corpuscles of immunized animals when added to the blood of non-immunized animals produces a specific action called hemolysis. This discovery was destined to reveal one of the peculiar features of immunity.<sup>2</sup>

**Immunity.**—Immunity may be briefly regarded as the condition of resistance to a given disease produced by the specific action of the

<sup>1</sup> Deutsche med. Wochenschrift, 1896, Nos. 7 and 8.

<sup>2</sup> Chetwood, loc. cit.



antibodies of that disease in the blood and is described as of two forms, active and passive. (1) Active immunity, also termed natural immunity, directly follows a disease and originates in the processes of recovery, including the development and action of antibodies in the blood specific for said disease. (2) Passive immunity, also sometimes called artificial immunity, is induced by the injection of the serum of an immunized animal, in dose determined by the disease and the age of the patient or by the injection of bacterial products or antibodies from the blood of animals previously immunized, beginning with small and continuing with regularly graduated and ascending doses until resistance to the disease is established.

**Anaphylaxis.**—Anaphylaxis is the converse of immunity and indicates a lowered resistance and an increased susceptibility to the disease, and is therefore dangerous and disadvantageous to the patient. Immunity, on the other hand, may be regarded as increased resistance and as decreased susceptibility, and is therefore a protective of the patient. The Theobald Smith reaction is the basis of anaphylaxis and rests on the following facts: If a small animal, such as the guinea-pig, is injected with a small measured quantity (1 c.c.) of the blood of an animal of a different species, such as the horse, and if again after ten to fourteen days the guinea-pig is injected with several times (3 to 5 c.c.) the original quantity of blood from the same animal (horse), death will occur in about one hour, during symptoms of extreme severity whose onset is almost immediately after the second injection. Other proteid substances are known to act similarly, especially bacterial products, and it is likely that death from snake poisoning at least in some forms belongs in this class of phenomena.

Serums are strictly obtained from the serum of immunized animals by processes whose description belongs to works on bacteriology, and bacterins are suspensions of inactivated and dead bacteria prepared in the laboratory. Both serums and bacterins are used by injection in the production of active and passive immunity. Serum contains the protective elements produced by the patient in the establishment of active immunity or by the animal in the laboratory during the same process. Thus it may be said that the injection of serums produces passive immunity by providing the subject with protection not produced by himself. The infection of the animal with organisms in the course of nature or the injection of living or dead organisms or their suspensions or emulsions, technically known as bacterins, confers on the other hand active immunity, because the subject must build up his own resistance against such natural or artificial invasion, and thus acquire immunity. One might call them respectively also conferred immunity and acquired immunity.

**Complement Fixation Test.**—As already indicated, in practical use the antibodies of greatest service are (1) the agglutins, familiar in the agglutination test of typhoid fever; (2) precipitins whose technical difficulties rule them out for diagnosis, but make them of value in medicolegal work, and (3) bacteriolysins and hemolysins. Pfeiffer

was the first to demonstrate that the blood has a direct destructive action on organisms, which he discovered from the fact that the peritoneal serum from a guinea-pig immunized to cholera possesses the power of causing both the death and disappearance of living cholera bacilli—in other words, the power of bacteriolysis. Pfeiffer furthermore showed that the corpuscles from the blood of an immunized animal when injected into another animal produced the specific hemolysis or destruction of the red cells, a phenomenon which is designated by the term hemolysis. If serum from an immunized animal containing hemolytic elements, technically known as amboceptor, is raised to 54° C. for thirty minutes or kept for several days at room temperature it is inactivated. The serum of an animal which is not immune, of either identical or other species, may be added fresh to the inactive serum for restoration of activity. Such restorative or reactive element is called complement. Two substances are therefore necessary for hemolysis, first a hemolysin or amboceptor, which is a specific body produced by the processes of immunization and rendered stable by exposure to temperature of less than 60° C., and second a complement, which is a nonspecific body contained in the serum of a nonimmunized animal.

Complement fixation tests are in common use in syphilis and gonococcal urethritis, and in less frequent use in echinococcus infections and in experimental, and as yet unsatisfactory application in tuberculosis. It is possible that with time a large number of diseases will be brought within the diagnostic value of this test.

**Preparation of Blood Specimen.**—The instruments and supplies required are: (1) for the field, sterilized towels, swabs, soap, alcohol and iodine and (2) for the surgeon, sterile gown or apron, needles with stylets, file, bottles or tubes with stoppers of cotton or cork or the means of hermetical seal and tourniquet. That arm of the patient is chosen having the best size and distribution of veins. The subject is placed on the table as a precaution against fainting, with the sleeve of the chosen arm rolled to the arm-pit. The surgeon washes and sterilizes his hands while the nurse prepares the skin of the patient by scrubbing the flexor aspect of the elbow for several inches above and below it, applies the tourniquet and places the towels on the upper arm, forearm and table and arranges the instruments for the surgeon's convenience. The patient clenches his fist firmly, which not only squeezes the blood from the muscles into the veins of the skin but also aids in fixing the veins. The surgeon accepts the most prominent and accessible vein, steadies the skin over it by downward traction and inserts the needle quickly with the bevel of the point upward so as to engage the surface of the vein instead of pushing it aside. The needle should be proportional with the size of the vein and after penetration is slid into the cavity of the vessel for perhaps a centimeter. The test-tube or bottle is applied to the outlet of the needle the instant blood appears, preferably by the assistant or nurse, as both the surgeon's hands are usually engaged. Active flow or pumping of the blood is

obtained by having the patient at intervals of every few seconds slowly open and deliberately and forcibly close his fist, thus pressing the blood from the depths of the muscle planes to the veins of the skin. The quantity of blood absolutely necessary is about 5 c.c. or 1 dram, but because many specimens require more than one examination in difficult cases as controls it is well to secure 15 c.c. The preservation of the blood is most important and is secured by aseptic precautions and immediate corking or sealing of the tube and then by placing them in an ice-box. It may be allowed to stand for separation of the serum in the ice-box or centrifuged before being placed there. These details rest with the laboratory expert and cannot be carried out by the practitioner, who rarely has suitable facilities. The transportation of the specimen is often an obstacle of success because the blood or serum must be sealed hermetically and delivery secured in twenty-four hours. Hot weather augments, cold weather decreases these difficulties. The tendency is therefore in many States for each county to have one or more State laboratories and for even small hospitals to equip the same in order to overcome these problems.

**Laboratory Technic.**—These complement fixation tests are so refined and difficult that they belong to the specialist in the laboratory field and cannot be wisely undertaken by the family practitioner, urologist or surgeon who cannot possibly possess the necessary special training or afford the time for the observation of individual tests, their repetitions and controls. In addition to this personal equation on the part of the operator, extensive apparatus is required exemplified by ice-chests, incubators, water-baths, centrifuges, glassware, racks and the like and added to these animal cages and runs for large numbers of guinea-pigs for the complement and rabbits immunized against the blood of sheep for the amboceptor. Access to a slaughter house at which perfectly fresh, sterile sheep's blood may be copiously obtained is also essential.

**Limitations of Laboratory Findings.**—Various contradictions seem to be present in the results of complement fixation work in the hands of different laboratories and the demand is increasing for standardized elements, methods and reports and it is likely that in time a central authority like the Board of Health of cities and States will undertake the production of elements of standard valence which will be employed by all workers and thus will secure less contradictory if not fully uniform results. These restrictions apply to all laboratory work of the refined order of complement fixation tests but for our purposes interest centers in that for gonococcal infection. For these reasons the author believes that, in cases of doubt wherein laboratory reports are at variance with clinical observation, a control specimen should be sent to the same laboratory for a second test and from the same quantity of blood at least two other laboratories of high order should receive specimens. Thereafter the average opinion is the one to be accepted.

**Gonococcal Complement Fixation Test.**—**Basis.**—The bacteriological and hemolytic principles underlying the gonococcal complement

fixation test are the same as those generally accepted for the syphilitic or Wassermann reaction. It is known as a fully accepted clinical fact, however, that the gonococcus occurs in a number of strains which vary from each other in virulence. Bacteriologists are not able to distinguish these strains with promptness on account of the difficulty of culturing the organism, so that in the complement reaction of this disease it is necessary to use a polyvalent antigen made up of a large number of strains. The greater this number the better, so that 10, 12 or 15 strains are now regarded as the most satisfactory combination, for certainty of including the given strain of gonococcus present in the patient. It would otherwise be necessary to isolate and recognize this strain and employ it in producing the antigen.

**Occurrence.**—The gonococcal complement fixation test is less constant and less reliable on the whole than is the Wassermann reaction in syphilis. It is said never to occur in both sexes before the disease has existed in its florid state for some time. Its most constant presence is in the chronic manifestations within the urethra and in the profound and chronic complications. It is therefore seen in the male in persistent chronic urethritis, prostatitis, seminal vesiculitis, and in the female in endometritis, pus tube, ovarian abscess and arthritis, as examples, proceeding from absorption in pus pockets in these lesions. When the gonococcus is present beyond doubt, this reaction is positive in about 100 per cent. of the cases examined and when a history of previous gonococcal infection is definite its satisfactory reports are also numerous. Schwartz and McNeal<sup>1</sup> did much of the original research work in this field and give the following table of results:

	No. of cases.	No.	Positives, per cent.
Chronic urethritis of gonorrheal origin:			
(a) Gonococci present . . . . .	4	4	100
(b) Gonococci not found . . . . .	36	27	80
(c) Examination for gonococci made . . . . .	8	7	90
Chronic prostatitis:			
(a) Gonorrheal history . . . . .	25	17	67
(b) Gonorrheal history doubtful . . . . .	2	1	50
Joint affections:			
(a) Gonorrheal arthritis . . . . .	14	14	100
(b) Gonorrheal arthritis questionable . . . . .	7	4	57
(c) Other joint affections . . . . .	9	1	11

### RESULTS OF TREATMENT.

In the introductory paragraph of this chapter the results of treatment were distinctly described as a fourth element in the diagnosis of a given case. On the one hand, while this dictum in the case of gonococcal disease is not as fully true as it is in the case of surgery and some conditions of medicine wherein exploration reveals the exact diagnosis and furnishes specimens for pathological proof, on the other hand, properly balanced treatment which necessarily involves careful

<sup>1</sup> Jour. Am. Med. Assoc., May, 1911.

exploration of a given case at repeated intervals does reveal the exact refinements of diagnosis. Rectal treatment will elicit foci of infection in the prostate, differences between the two seminal vesicles and urethral exploration with finger and instruments and the urethroscope will invariably define conditions which would otherwise escape recognition. Beyond these generalizations one may not pass in a work of this size, but the relation of treatment to final diagnosis is at once apparent, because many of these details of diagnosis are matters of development and observation during treatment.

Urethroscopy in diagnosis and in treatment is so vast a subject that like cystoscopy it is treated in a separate chapter.

### DIAGNOSIS OF ACUTE AND CHRONIC COMPLICATIONS.

**Genital and Urinary Groups.—General Principles.**—The preceding paragraphs are concerned with the establishment of the fact of gonococcal invasion to the exclusion of other infections, and its diagnostic principles were laid down as four elements. In the recognition of gonococcal complications, the data of history, symptoms, laboratory investigation and treatment must also be elicited and deductions therefrom reached. During gonococcal disease, as already shown in the chapters on complications, the incidence of the complications is either in the genital and urinary groups or the extragenital group of organs. Complications arising in the urogenital system may be said to do so by subsequence or by concurrence, because one sees as a rule first the urethral involvement as the primary focus followed by the complication as the secondary or subsequent focus and as a less frequent experience the urethritis and its complication arise practically together as concurrents. Examples of the latter are urethritis, accompanied by phimosis and balanoposthitis in the acute disease and relapses of chronic disease in which several organs may be simultaneously involved, such as the urethra, prostate, testicles and seminal vesicles.

**Extragenital Group.**—Complications appearing in the extragenital groups of organs may be coincidences, because an entirely different disease may invade the patient during his urethritis exactly as he may fall and break his leg during his urethritis. Thus in this group the diagnosis must be very carefully established in order to avoid error especially when such complications are of the more rare forms by metastasis.

The determination in both groups must include physical examination, urethroscopy, cystoscopy, urinalysis, blood tests, and bacteriologic smears and cultures.

**Diagnosis in the Female.**—*General principles* are the same as those discussed in the male and are a careful history, minute physical examination, full laboratory investigation and often the results of treatment before absolute judgment is reached. The essentials are the same in comprising repeated specimens properly collected and

pared, careful differential staining, timetaking search, culture and food test.

The *sites of infection* are the urethra, vulva and vagina in the early cases and later, as already stated, in ascending order the other mucosæ of the sexual tract in extending cases and the mucosæ of the urinary tract and extragenital tracts in the complicated forms. The *sites for specimens* are the urethra, the vulvovaginal glands, the posterior fornix of the vagina and the lower cavity of the cervix. The author prefers to collect two slides from each of these points and recognizes that specimens of little value are obtained from the female quiescent which means the condition of the patient for ordinary investigation in institution or office but that preparations of great value are secured from the female stimulated, which means through the period of physiological hyperemia and increased discharge, immediately before or after menses, during the late decline of lochia after miscarriage or childbirth, during sexual desire and in alcoholism, and through the period of artificial congestion and exudate after the local application of stimulants, such as 10 per cent. nitrate of silver or massage, respectively leading to superficial irritation, desquamation and discharge and to glandular evacuation by pressure and manipulation. The hollow of the blades of the bivalve speculum will often receive from the cervix or wall of the vagina a valuable specimen which should be added to the slides already secured. About forty-eight hours must elapse between the application of the mild caustic and the taking of the specimen, otherwise no organisms will be found through the destructive quality of the solution.

In the urethra, after washing the vestibule with cotton and boric acid water, nitrate of silver 10 per cent. may be swabbed or instilled into the lower canal and specimens taken on the second day. By the vaginal touch two fingers are placed in the vagina supporting the anal and drawn forward with firm pressure against the arch of the symphysis, literally "milking" the mucosa of all glandular contents and exudate upon its surface. In the other hand the operator has a sterile swab ready for wiping off the discharge and transferring it to microscopic slides. Skene's glands are most important and are evacuated with two fingers in the vagina to steady the urethra and a common sterilized hairpin drawn over each gland with pressure against each finger in turn. The drop of pus is secured on a swab for the slide.

In the vestibular or vulvovaginal glands, after cleansing the vestibule and labia, one or two fingers are inserted into the vagina while the thumb of the same hand or two fingers of the opposite hand gently squeeze the gland until exudate appears. The drop of pus is received on a swab or directly on a slide. Sometimes the ducts of these glands will permit a small platinum loop to be inserted.

In the posterior fornix of the vagina, after washing off the vulva, a speculum without lubricant other than water is gently inserted and opened so as to bring the cervix and fornix well under control. The specimen may be secured with the swab or platinum loop directly or

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In the posterior fornix of the vagina, after washing off the vulva, a speculum without lubricant other than water is gently inserted and opened so as to bring the cervix and fornix well under control. The specimen may be secured with the swab or platinum loop directly or

after gentle curettement with a hairpin in a hemostat. In cases of doubt the vault of the vagina is mopped liberally with 10 per cent. nitrate of silver at the first visit and on the second day when the intense reaction and the destruction of organisms have ceased the specimen is taken.

In the cervix lies one of the most important foci and, in acknowledged infection, negative specimens must be numerous and consistent for proof of cure. The glands may be expressed by massage with the fingers in sterile gloves or by gentle dilatation with a small-sized Goodell dilator or by gentle curettement with a hairpin in the jaws of a clamp. The drop is taken up with a platinum loop or sterile swab. The period of physiological hyperemia and discharge incident to the menses, postpartum conditions, sexual excitement or intercourse and the period of artificial congestion after swabbing with nitrate of silver are propitious for successful specimens.

The time for specimens, as in the male, is the early morning, because then the urethra contains accumulated mucus which should not be cleansed by urination before the test; because then the cervix has filled the posterior fornix with its discharge, which should not be removed by douche or allowed to escape by much bodily activity; and because then the vulvovaginal glands if draining are full after the recumbent position of sleep. There should, therefore, be no urination, no defecation and no douche from the night before to the morning of examination. If the patient eats a light evening meal and partakes of little fluid during the evening these restrictions are easily obeyed.

These special features apply to the female. All the general features are alike in both sexes.

## CHAPTER IX.

### GENERAL PRINCIPLES OF TREATMENT.

**TREATMENT** should be discussed under a number of headings, no matter what the disease under consideration is. These headings are commonly accepted in gonococcal disease as: prophylaxis, both personal and social, abortive measures, palliation, curative measures both expectant and irrigative, management, medicinal and surgical means. Sharp lines of distinction are not possible because methods under one heading may in their application and effects pass over into another heading. In general, curative measures are those which are directly applied to the infection by the gonococcus in the local urethritis or its complications or in systemic effect when such arises. In this sense all other measures are palliative in that they soothe the patient and relieve his symptoms with only indirect effect on the infection.

#### PREVENTIVE TREATMENT.

**Varieties.**—Prevention of an acquired disease like urethritis is two-fold—personal, relating to the patient himself and social, concerning his associates at home and abroad.

**Personal Prophylaxis.**—**Significance.**—Personal prophylaxis is justified and required in order to protect the individual as far as possible against the social conditions and the high cost of living which remotely postpone or even absolutely prevent marriage at that time of life when Nature intended it should occur. Thus there arises the temptation and the means of sexual promiscuity and immorality which the continent in both sexes do not resist and in a certain sense can hardly be expected to resist, no matter how much these sad facts may be lamented. The dictum often heard, therefore, that such persons should be penalized by the results of their indiscretions is both unreasonable and unfair, just as much as would be the dictum that the victims of tuberculosis should receive no aid because they often live in squalor, which is a potent source of tuberculosis. The writer has never found a man or woman the victim of venereal disease and having a reasonable normal view of life who did not regret this situation and state that marriage with an individual fulfilling other relations, attractions and happiness than the merely sexual tie would be much preferable to promiscuity and immorality. In other words, therefore, the home and parental instinct and the spirit of devotion to one human being is after all predominant but cannot often be satisfied in present social conditions for which society is responsible and against which society must furnish protection to the individual, as far as possible.

In children, gonococcal infection is somewhat more common in girls

than in boys because in the use of the diaper the sexual organs being wide open in the female are very easily infected from the fingers of attendants and utensils, as is evidenced by epidemics of vaginitis in institutions, usually of specific type. The results thereof are often endometritis, infantile uterus and sterility—abundant grounds for personal prophylaxis. Infection of the eyes in children belongs more properly to the subject of social prophylaxis (see page 486). Balanoposthitis and urethritis in young boys is often of gonococcal origin and may lead to devastating sequels in their sexual and urinary systems. Again prophylaxis is required.

In females the damage of the internal sexual organs—ovaries, tubes and womb—by the essentially destructive character of gonococcal invasion leads either to unsexing operations for the removal of these organs in order to save life or to prevent years of marked invalidism or to avoid relative sterility in that stenoses, torsions and other deformities of the tubes and numerous profound inflammatory changes in the ovaries and the uterus prevent the ovum from reaching the womb and pregnancy from occurring, although the organs may have otherwise recovered from the initial invasion. Personal prophylaxis for the woman should therefore be aimed at, avoiding this damage and loss of health. Ascent of the disease into the bladder and kidneys is another important thing for preventive measures.

In males the infection all too frequently travels from the urethra into the prostate, seminal vesicles, vasa deferentia, epididymes and testes, where, as in the woman, they often lead to unsexing sequels so that many men who have recovered from the infection and may safely marry are sterile, although the presence of their testes permits intercourse in the normal frequency and energy but without the normal physiologic impregnating power. The infection may pass into the urinary organs—bladder, ureters and kidneys—and by damaging them beyond cure incapacitate the man during a life usually much shortened by these lesions.

**Technic.**—Ignorance of the nature of his disease on the part of the patient, male or female, is met by instruction preferably through printed pamphlets or leaflets which should cover at least the following points—the bacterial nature and communicability of the disease, the obscurity and persistence of chronic infection, the cautions in personal care, management and treatment under the physician's guidance and the responsibilities for infection of the innocent through dressings and utensils and sexual relations particularly in wedlock.

Normal intercourse is essential with prompt ejaculation and without prolonged and unnatural excitation and without frequent repetition and finally without delays voluntarily produced or proceeding from physical exhaustion or inebriety. The gonococcus grows on an alkaline medium which is advantageously produced by the outpouring of mucus into the urethra from the mucous glands during erection. This alkalinity may be largely neutralized and the gonococcus removed with the mucus by the acidity of the urine. It is, therefore, well to

ve intercourse when the bladder is partially or completely full of ine and to urinate immediately after the act. In the female a douche fore intercourse is a protection to the male and one after it is a safeguard to herself. Abstinence from intercourse with women just before and just after their menstrual flow is important because the congestion of these periods often brings gonococci to the front which are otherwise not inocuable and because many women who have no gonococcal infection are at this period very acrid and may excite a chemical rather than a bacterial urethritis.

The condom or cover at once departs from the principle of natural intercourse but it is a good safeguard provided it does not tear or break, there is a great prejudice against its use among men on the ground that it reduces the pleasure and injures them and by women on the former ground and that of dryness and discomfort. It certainly prevents sensation exactly as a glove on the hand limits perception of the quality of material in shopping, for example; but when the glove is removed from the hand the sense of touch is shown to be unaffected and no injury to have resulted to it by the wearing of the glove. On the same basis, when the condom is not used sensation in each sex is shown to be unimpaired and no injury thereto to have followed its previous employment. This argument is an axiom but a most difficult one for the laity to accept. There is no question, however, that the condom is uncomfortable even when lubricated but it remains the best single preventive known, although Luys<sup>1</sup> dismisses it with these words: "It is said to be a kind of cobweb against the danger, and an armour against pleasure."

**Treatment of the male after coitus** should be taught as essential and consists in calling at the physician's office within twelve hours when smear and culture specimens must be carefully taken. The method of a single application of 1 to 3 per cent. nitrate of silver within the first two inches of the urethra or the irrigation of the same region with antiseptics or the instillation and sealing of the same in the canal as described under Abortive Treatment on page 49, may be carried out. The patient may be given a mild hand injection of 3 to 5 per cent. argyrol or 0.5 to 1 per cent. protargol two or three times a day for the first three days. Immediately after intercourse the penis should be washed with soap and water, especially if the foreskin is long, and on reaching home immersed in a glass of hot antiseptic 5 or 10 per cent. argyrol or 1 to 2 per cent. protargol solution at about 105° to 110° F., and these as hand injections may be continued for two or three days. At the end of this period specimens should again be taken from the mild catarrhal inflammation apt to be excited by these steps. If the organisms are present, then the systematic regular treatment must be instituted. The author has frequently prevented infection by these personal prophylactic measures and believes that they will not fail if carried out within twelve hours of sexual congress.

<sup>1</sup> Text-book on Gonorrhea, English edition, 1913, p. 271.

**Treatment of the female after coitus** is along exactly the same lines within twelve hours of a suspicious intercourse. The method of one application of 1 to 3 per cent. nitrate of silver to the vulva, urethra, vagina and cervix may be done with less pain than in the male, because the mucosa is less sensitive, or the external organs may be thoroughly washed with soap and water and douched with a pitcher full of 1 to 2000 potassium permanganate solution followed by irrigation of the vagina with a gallon of the same solution at 110° F. in the lying down position. The urethra had best always be swabbed with 1 per cent. nitrate of silver. Attention to the external organs with the douches should be repeated from two to four times a day for three days and swabbing the urethra each day or every other day of the same period. The preliminary smear and culture findings must be repeated at the end of this time and if then positive the standard continued treatment should be at once instituted. The author has had the privilege of preventing the extension of a number of infections innocently acquired in wedlock by these procedures, so that the time and energy are alike worth while for patient and physician.

**Treatment of children after coitus** is extremely rare because knowledge of it does not appear until the disease is established. Rape of female children and forcible intercourse of women with boys are not so uncommon. The methods described for adults of both sexes must be suitably modified for the children.

Syphilis and chancroids must not be forgotten as possibilities equally with gonococcal urethritis. Fortunately, the organisms of these two diseases are slow in their invasion and rather vulnerable in their character so that the measures against the gonococcus are usually sufficient, especially the soap and water cleansing and the penile bath and vulvar douche. Ammoniated mercurial ointment or mercurial ointment may be applied in addition for the first twenty-four or forty-eight hours, secured by a suitable dressing in each sex, while the other prophylaxis is being done.

**Social Prophylaxis.—Importance.**—Social prophylaxis is essential for the protection of society against the spread of gonococcal and other venereal diseases among the innocent which may occur from unsuspected infections existing in supposedly cured patients, as well as from more or less deliberate and vicious inoculation. Children, women and men are alike concerned in this matter and for each the sociologic importance is obvious when the history of infectious diseases is remembered in the light of modern bacteriology.

In children blindness of the newborn was a very common disease, especially in institutions and among the poor, before Credé evolved the simple expedient of sterilizing the conjunctivæ of all infants at birth with 1 per cent. watery solution of silver nitrate, with normal salt solution instillations to allay the secondary irritation. Destruction of the gonococcus rubbed into the eyes of the babies during birth was thus immediate within the conjunctivæ and cleanliness of the skin prevented reinoculation from the face. Similarly in children the first

ign of vaginitis or of balanoposthitis requires bacteriologic investigation and prophylaxis for the protection of the other members of the household or ward.

In females innocent infection occurs by husbands discharged as cured or otherwise ignorantly the source of disease and the extension of the infection in continuity from the external organs to the ovaries with almost invariable unsexing of the patient makes the disease very serious. Conversely, women who were infected in a life of immorality from which they have reformed or in a previous marriage may in the same way unsuspectingly infect their husbands. In the former circumstances such women usually belong to the supposedly cured class and in the latter often to those who never knew anything of their original malady, although treated and "cured." Society should adopt steps to make such cases more and more uncommon if not unknown. Finally, there is the woman who as a professional prostitute intentionally and deliberately infects everyone she meets, against whom society should also evolve regulations of sanitary character although absolute prevention is impossible. The author cannot see the sociologic sense of declaring such laws unconstitutional simply because venereal, wrongly called private, diseases are involved. The carrier of any infection, no matter what system of organs it compromises and no matter how it was acquired, is a source of danger to the community economically, socially and personally. The carrier of venereal disease should not be allowed unrestrained license to spread it any more than the victim of scarlatina and it is probable that in time society will wake up to this responsibility and treat the victim of venereal disease in either sex by segregation as the first step. It is certainly almost criminal to say that the prostitute should spread her virus unrestrained because relations had with her are immoral. Such immorality would probably largely disappear or at least become minimal instead of widespread and flagrant if the organization of society made early marriage possible. The community is responsible for this situation and equally with the individual must begin the restitution.

In males "cured" cases often infect their wives unknowingly because full bacteriologic investigation was not done before discharge from treatment or because the patient refused to heed advice. Conversely, like the prostitute, some men will viciously infect women although they have good reason to know that they are carriers of the disease. Both circumstances require in each sex suitable instruction preferably by prophylactic pamphlets or leaflets such as most boards of health, many hospitals and clinics, and an increasing number of physicians in their private practice now give out. Unsuspecting infection by the male arises from complications in the glands of the urethra, prostate, seminal vesicle and epididymis because the infectious material cannot be secured excepting under sexual stimulation and ejaculation. Social order requires limitation of these accidents by suitable preventive measures.

In general gonococcal disease in either sex and at all ages may be



described as a devastation of the sexual organs more rather than less serious, as a menace to the reproductive power of the individual in after life and as all too frequently a burden on the bodily health, as exemplified in the sections on Extragenital Complications of Acute and Chronic Urethritis, on pages 201 and 313, with particular reference to the sequels in the urinary, circulatory and locomotory systems. An offender with such a long list of pathological crimes certainly deserves the sentence of full prophylactic measures of all kinds both possible and practical, and both personal and social.

**Technic.**—Final responsibility does not rest with medical science nor with the medical practitioner who exercises all reasonable known precautions and methods of examination, but does accrue to the individual who more or less voluntarily and incontinently acquired the disease. This is an argument which the writer never fails to advance to a patient seeking advice as to marriageability, because methods of investigation may fail to detect foci of infection which the sexual stimulation of wedlock lights up. Fitness for marriage in either man or woman must rest on smear and culture bacteriologic tests and on the gonococcal complement fixation test, and the former must be obtained in both the quiescent and the stimulated conditions.

In the male quiescent, urine should be retained in the bladder as long as possible so as to permit secretion to accumulate in the urethra. After four or five hours' supply of urine, smear and culture are taken from the urethra with the sterilized platinum needle after massage of the prostate, seminal vesicles and urethra combined with stripping of the canal to bring the products to the meatus. Urination into Glass I brings with it the contents of the canal and the massage may be repeated and its product secured by evacuating the bladder completely into Glass II. Another method is to strip the urethra for the smear and culture, then secure Glass I, next massage the prostate and vesicles and take Glass II. With the platinum needle shreds from the anterior urethra and thickened masses of mucus or pus are secured for the cover glass and culture preparations which should be several in number for the fullest possible laboratory investigation. In the male stimulated effort is to secure specimens from the mucous membrane and the sexual organs. A sound or dilator may be passed, mild irritating irrigations employed and excitants such as alcohol in the so-called "beer test" and highly seasoned foods may be employed to stimulate the mucosa to more than usual exudation. The best test is that of securing semen in a condom, especially when the patient is married and has acquired the disease guiltily and desires to return to his family tie. It is an open question whether the intercourse test should be recommended for single men on moral grounds, but the question may be compromised by having the patient wear a condom at night. This procedure soon induces a seminal emission and answers the purpose.

In general it may be said that a man is marriageable when he is free of all clinical manifestations of the disease and has so remained for

considerable space of time, many weeks or several months rather than a few days or a few weeks and when the most strict laboratory examination of specimens secured during repeated quiescent and stimulated states are negative and when the gonococcal fixation test is negative. On the other hand, it is extremely doubtful whether he is marriageable at all in the presence of chronic lesions which give clinical symptoms, such as shreds in the urine and a morning drop proceeding from foci in the prostate, seminal vesicles or testicles. Careful laboratory examinations and even the blood test may all be negative. There is always danger, however, that frequency of intercourse in marriage may cause appearance of infection otherwise not detected and thus opinion should be given with reserve and caution and the responsibility placed with the individual and not with the science of medicine.

The female quiescent, without a douche for at least twenty-four hours, should produce smear and culture specimens from the secretion of the vulva, urethra after expression of the contents of Skene's glands, the vulvovaginal glands after massage and expression of their secretion, the posterior cul-de-sac where the cervix drains into the vagina and the cervix uteri. Examination of the womb and its annexa by the bimanual method for changes in consistency, mobility, size, tenderness and the like with appearance of discharge at the close of the manipulation is of definite aid. The female stimulated is investigated by pressure on the glands of Skene in the urethra with a hairpin or other blunt instrument, by fairly active massage of the vulvovaginal glands, by mild, blunt curetting of the mucosa of the cul-de-sac and cervix and by applications of 1 or 2 per cent. silver nitrate followed within twenty-four hours by the taking of the specimen. Sexual congress in woman is not to be recommended for producing the congestion which will bring hidden organisms to the surface, but the increased flow of mucus just before and after menstruation rests on hyperemia and often contains organisms otherwise not discovered.

In general, as in the male, rules of prophylaxis cannot be too rigid. Numerous tests must be made in the three general periods of quiescence and excitement by chemical applications and by menstruation. All the common foci of infection must be repeatedly explored as just enumerated. If these tests are negative and if there are no clinical signs of disease, the woman may be pronounced with reasonable certainty cured, and such adverse chance as may remain is not the responsibility of medical science but of the individual if infected by immorality or of her husband if diseased through marital infidelity. In the female, as in the male, there are undoubtedly foci which occasionally though rarely harbor the gonococcus for long periods, undiscoverable by examination and only uncoverable by the regular sexual stimulation of married life. In particular in the female also, if there are clinical signs of disease which defy treatment, such as persistence of leucorrhœa and the meatal urethral drop, pus in the vulvovaginal glands and cul-de-sac and mucopurulent discharge from the cervix and inflammatory fixation and other changes in the womb and its annexa after a known

gonococcal infection, then great caution must be exercised in the decision of marriageability although all tests may be in themselves negative.

Gonococcal complement fixation test is of great value in the determination of the presence of foci causing absorption but clinically perhaps undiscovered or difficult of approach for the purely bacteriologic diagnosis. Obviously, it applies equally well in both sexes and is looked upon as more reliable for prophylaxis than is the syphilitic complement fixation test—called the Wassermann reaction. It possesses great technical difficulties in the culture of the fifteen or more strains of the gonococcus for the preparation of the antigen and must therefore be performed by a very competent laboratory.

### ABORTIVE TREATMENT.

**Purposes.**—The aim of abortive treatment is to overcome the infection during the earliest periods when the subjective symptoms are minimal and perceived only by the most intelligent subjects. This means that the case must be reached before the period of exfoliation is past and before the stage of penetration is established with the gonococcus deep in the epithelial layers. The lesions must be at the meatus and its annexa and not extended far back in the canal.

**Selection of Case.**—It follows, therefore, that the patient must be seen very early, while the discharge is scanty and serous, mucous, seromucous, as a thin watery moisture or a slight stickiness according to the proportion the mucus or the serum predominates. To the naked eye the fluid is clear and to the microscope it contains epithelia, pus, gonococci, without or with other organisms, all in moderate quantities. In short, the patient should be seen during the first twelve hours after coitus. Any time longer than twenty-four hours directly militates against success.

**Methods.**—The means of abortive treatment are those of application, irrigation, injection, instillation by the patient and instillation with retention (Ballenger's method). The chief point is to prefer the gentlest method possible with nonirritating solutions and with rather frequent attention and long retention. For these reasons the author prefers the syringe-and-catheter irrigation with 1 in 8000 to 1 in 4000 solution of potassium permanganate two or three times daily, hot within comfort and under pressure without pain or distress and applied only to the anterior urethra after urination. In the intervals between these irrigations the patient instils with a medicine dropper argyrol solution, 3 to 10 per cent., into the meatus and fossa while the penis is held in the vertical position. By capillary attraction between the surfaces of the collapsed walls of the urethra the fluid will travel back as far as necessary. The patient retains these drops for at least ten minutes and may furthermore soak his penis in hot mild antiseptics, such as the foregoing solutions of potassium permanganate and argyrol. Hand injections are apt to be overdone by the ignorant and should be reserved for the intelligent class. These details are continued from

three to five days with frequent bacteriologic investigation to judge of their effects on the organisms and epithelia.

*Instillation and Retention Method.*—This is the procedure of Ballenger as noted in the section on the details of abortive treatment of acute urethritis on page 49. Its principles are very early diagnosis and the instillation of not more than 30 minims of argyrol solution 5 per cent. and then sealing the same into the urethra with collodion and cotton for about five hours and repeating the process each day for several days until the gonococci disappear. Ballenger is positive of his records and enthusiastic about his results. The author has had no experience with the method because it is so difficult to have dispensary patients call at the proper period for its successful application. In theory, however, and on the basis of Ballenger's reports the technic makes a strong appeal for itself.

The full details of all these abortive methods will be found in the Chapter on Acute Urethritis in the sections on treatment.

### PALLIATIVE TREATMENT.

*Purpose.*—Palliation is aimed to relieve symptoms rather than really cure lesions. In gonococcal disease the symptoms follow so rapidly upon each other and cause so much distress that comfort must be secured definitely. The predominant symptoms are due to congestion, irritation, discharge and disturbed function—all due to the activity of infecting organism. The destruction of the gonococcus is in a certain sense the one true curative measure and will relieve all the foregoing conditions; but other treatments are necessary in order to palliate the suffering while the invariably slow process of this destruction is in development.

*Methods.*—The congestion is relieved by sedatives by internal administration and decongestants locally applied. Among the best are the thermic measures, cold in the ice-bag or coil and heat in the bag or sitz bath and heliotherapy, which are best in the acute period but available in the chronic stages especially with exacerbations. Electrotherapy by selected method is of use in the chronic period. Irritation corresponds with the congestion and is indirectly benefited by the same measures. The sedatives by mouth are especially good, chiefly for the urinary and sexual disturbance. The urine is diluted and neutralized by the drinking of plain or alkaline water without inducing undue frequency or urgency. The sexual irritation is primarily prevented by avoiding all direct and indirect sexual stimulation, and secondarily corrected by the further administration of sedatives and by regular evacuation of the bladder.

The discharge is the chief sign of the disease and its true palliation is closely identified with its cure because as the discharge disappears the infection decreases and the germ vanishes. On the other hand, the severity of the discharge may be diminished by reducing the congestion and the irritation and by the rest and quiet of good management.

Perhaps above all other details judicious treatment which does not increase the discharge is to be remembered. Disturbed function embraces the frequency and pain of urination and the repetition and excitement of sexual reflexes. All are interwoven with the other symptoms and are therefore soothed and palliated by the measures already alluded to, notably by sedatives systemically administered and by the local influence of hydrotherapy, the relief of the infection and the neutralization of the urine.

### CURATIVE TREATMENT.

**Purposes.**—A cure cannot be established unless the gonococcus is destroyed as the primary factor in the disease and unless the mucosa is reasonably restored and unless the full function of all the tissues and organs attacked is virtually revived. The former aim is rather easily attained, while the latter is often impossible in the full sense because the mucosa is so badly damaged. As long as the gonococcus survives, the case is not cured and relapse is possible and complications somewhat likely and most important infection of the opposite sex innocently in wedlock is a certainty. The mucosa is often restored in many cases so far as the exfoliation and much of the penetration are concerned. Scar tissue formation in the form of stricture and thickenings, however, cannot be removed. The function is renewed in the little glands of the mucosa and in the annexa of the urethra. Mucous crypts are stimulated to healthy secretion in both sexes and the prostate, testes, vasa deferentia, and seminal vesicles in the male should regain their physiology and in the female the lining of the uterus should cast off the catarrhal aftereffects, the tubes become patent and ovulation occur normally—all as fully discussed under the treatment of the various lesions of these organs in the male and female.

**Methods.**—The cure is reached in general by one of two methods—expectant or radical, commonly called irrigation—or by both combined in judicious proportion, as perhaps the best method.

**Expectant Method.**—The expectant plan makes great study of the periods and symptoms of the disease and rests on correct diagnosis of lesions no matter whether acute or chronic. In a certain sense it demands management, diet, rest and internal medication as systemic means for their local effects until the acute period is over. Then the local means for local effects are employed chiefly as hand injections by the patient and syringe-and-catheter irrigations by the surgeon. Mild strengths of solution, frequent but gentle applications, and long retention of fluids are the ground work. Physical measures, if applied at all during the acute period, are comprised only in hydrotherapy as heat or cold according to comfort and result or in heliotherapy of mild degree and long duration. Massage and electrotherapy are interdicted. Medicinal measures must not be disturbing to the patient's local or systemic economy. During chronic periods the conditions change. Any case which has lasted from three to four

months is of essentially chronic pathogenesis. The diagnosis must be correct and is of prime importance. The history reveals the duration and frequency of antecedent attacks. Symptoms indicate the activity and relapses of the disease, while physical examination detects the chief lesions and verifies them with the urethroscope, cystoscope and the laboratory specimens, which finally reveal the infectiousness. Response by the patient subjectively and objectively is the best guide of method and manner and frequency of treatment.

As a rule, no two methods of treatment should be combined at one sitting; for example, massage of the prostate or seminal vesicles should not be combined with a passage of a sound because the latter is also a form of massage. An exception is the use of Bangs's urethral sound in associating instillation with dilatation and the employment of the author's irrigating sounds in correlating dilatation with lavage of the bladder and retrojection of the urethra. These exceptions hold because one passage accomplishes two things with the instrument. The medicines employed are essentially mild in such procedures.

All overstimulation is avoided by any means whatever—digital or instrumental, thermal or chemical, physical or electrical and finally physiological, directly or indirectly, because any such stimulation has a direct tendency to add to the inflammation. The general frequency of treatment, if excessive, is another means of increasing the inflammation. In general, whenever the symptoms increase the frequency is either too little or too much—a question which must be decided by the course of the disease after a change in either direction. Undue activity is usually a mistake by the patient in the use of his hand injection.

The absence of progress indicates a change in the treatment or disobedience by the patient to advice or orders. The urethral treatment may be wrong or too strong, the visits too frequent and instrumental applications too irritating. Caution cannot be too great about any reaction to sounds so that flexible instruments are much to be preferred to steel instruments even in the hands of the expert and especially in the hands of the general practitioner. The patient may be disobedient in indulging in normal or perverted intercourse or in irregularity in diet, drink or habits. The author had a case whose stationary condition rested solely on frequent sexual perversions, which he thought were not harmful, although he abstained from normal coitus, which he recognized as harmful because forbidden. He rapidly recovered when the perversions *ab ore* were abandoned.

*Irrigation Method.*—This method is sometimes called the radical plan because it has more respect for the immediate destruction of the infecting organism as such than it has for the periods and symptoms of the disease as guides to the details of treatment. Its minutiae are fully covered in the paragraphs dealing with this method in the treatment with each lesion of the gonococcus as it arises. The author believes that the good points of the irrigation method involved in the gentleness of the syringe-and-catheter procedure when combined with the instincts

of the expectant method in respecting the stages of the disease are probably the best plan of treating acute urethritis. The term combined method might be applied to this development of treatment.

### **SYMPTOMATIC TREATMENT.**

**Purposes.**—Symptomatic measures are like palliation and synonymous with it. The indications offered by the patient's sufferings are sufficiently discussed under palliative treatment.

**Methods.**—The patient's story should be carefully elicited and the subjective local symptoms and subjective systemic syndrome must be known. A careful objective examination verifies these leads for the local and systemic objective corroboration. No method of examination can be omitted. The older methods of physical investigation are always employed—inspection, palpation, mensuration, percussion and auscultation. These must be augmented by special examination, such as the laboratory analyses of urine, semen and discharge, bacteriology in smear and culture and hematology for bacteremia and the complement fixation tests. Instrumental and digital investigation, are possible, and are employed for the rectum, urethra, bladder, ureters and kidneys, including urethroscopy and cystoscopy and functional tests of the kidneys. When the pathogenesis of the symptom is determined then the method of treatment is selected, on the principles just discussed, and so continued.

### **INDICATIONS OF TREATMENT.**

**Varieties.**—There are two aspects of this subject: the pathologic and the symptomatic. The symptomatic indications are fully synonymous with symptomatic treatment as already discussed in the preceding paragraph.

**Pathologic Indications.**—Due regard must be had for the essence of the lesions, as produced by a germ active, penetrating and extending. Such regard determines avoidance of any treatment which will overstimulate, irritate or damage the mucosa and thus increase the disease in extent and depth by causing a traumatic inflammation, either physical, chemical or thermal. The tissues involved should be remembered as finally the mucosa in all its layers. The epithelia of the surface of the mucosa and its glandules are primarily compromised, and then secondarily the submucosa with the underlying connective tissue. The same law of invasion and advance is noticed in the organs attacked. The mucosa at first of the ducts and then of the acini and finally of the stroma and the parenchyma in small or large zones suffers. The temporary lesions are chiefly exfoliation, which may be fully restored, and small round-cell infiltration, which may be entirely absorbed. Hence no treatment must excite undue shedding of the epithelia or chemical inflammation of the surface and depths of the lining. The permanent lesions represent replacement of normal by substitution



tissue. Columnar epithelia gives way to squamous cells, soft fibro-elastic tissue is changed into dense fibrous tissue or that which is much less elastic. Both processes are invited and increased by harsh treatment and, in fact, such treatment will, if extreme, induce them in perfectly normal mucosa. The associated lesions, if gonococcal, follow the same pathogenesis. The most common associated lesion is, of course, the urethritis from which other important lesions have arisen. The same statements concerning complicating lesions apply with equal force. The gonococcus and its allies constitute the bacteriology of each case and the latter must always be in mind in the matter of orrhodiagnosis and orrhoterapy.

### MANAGEMENT.

**Definition.**—The general care of the patient, not including the administration of drugs, constitutes management.

**Importance.**—The importance of good management almost equals that of the proper selection and administration of both internal and local measures and is in fact the groundwork on which reposes the absence of errors chiefly by the patient and sometimes by the doctor, which add to the disease and delay recovery. Under this heading are necessarily included the general subjects of hygiene, rest, diet, drink, nursing, dressing.

**Hygiene.**—Gould<sup>1</sup> defines this term as follows: "The science that treats of the laws of health in its broadest sense." Employing this term in a similarly free sense the author means all those elements of general and local care which avoid factors which in any way endanger progress of the disease, limit the effects of treatment and invite the inoculation of others. In part, therefore, hygiene of gonococcal disease is embraced under management and again under prophylaxis, personal and social. It likewise embraces each of the other elements named at the close of the section on Management. It may be accepted, therefore, to mean the general common sense essential in the respect by the patient for his bodily processes in any disease.

**Rest.**—Relief of the body of weariness, which in the stress of everyday life somewhat invites sickness and indirectly increases it, is a very important element in gonococcal disease when the patient is not doing well. In all the armies and navies of the world the enlisted men, when infected, are immediately put to bed for at least three reasons: (1) the repose limits the extension of the disease and often prevents complications; (2) the patient is fully under the control of the medical officer and under the hourly care of the nurse; (3) the patient learns a greater respect for his affliction and is decidedly constrained in his likelihood to infect others. Every urologist has had familiar examples of cases who did badly while ambulant but extremely well as soon as put to bed. Bodily rest has therefore at least the foregoing advantages and it is unfortunate that social conditions prevent this treatment in the

<sup>1</sup> Illustrated Dictionary of Medicine, Biology and Allied Sciences, 1902.

majority of cases. Sexual rest is a detail which demands more attention in a certain sense because every intelligent patient can carry it out. The victim of gonococcal infection may expect indefinite amounts of trouble if he is ever exciting his disease by exciting his sexual passion, indirectly by the companionship of women which may be avoided or by the fondling of his fiancée which may be largely limited if not totally stopped, or directly by intercourse when he thinks his disease is well but before the surgeon after the most careful analysis, as described under the headings of Diagnosis and Cure of each lesion in turn, has declared it well. In the female, as in the male, absence of sexual rest largely defeats treatment, as is seen in the prostitute who continues her initial infection by her life and also incurs the risk of reinfection.

**Diet.**—Full details of this subject cannot be drawn and the reader is referred to works on the subject. In general, the fever diet employed in most hospitals consisting of fluids is available. Milk and milk products alone or mixed with Vichy or carbonic water, light soups and broths with little seasoning, breadstuffs, fish and mild fruits are all available as the case begins to improve. Later, when the acute symptoms are past, the easily digested vegetables followed by meats with chicken first are all added. In general, that diet is avoided which tends to increase crystals in the urine. Meat usually develops uric acid and urates, while oxalates may be produced by tomatoes, asparagus, rhubarb and strawberries. If the patient uses a diet which he digests freely without constipation or urinary disturbance in health, he may employ the same diet after the severe period of the gonococcal disease has passed.

**Drinks.**—Mineral waters, especially of the alkaline and mildly diuretic types, are best. Even plain water with a pinch of bicarbonate of soda (10 to 15 grains) is a good substitute. The fluid of the diet must not be forgotten in determining the quantity of water to be taken, which must not be so great as to increase the blood-pressure or to congest the bladder and prostate by the bulk of fluid excreted. The object is only such frequency of urination as to dilute the acidity if not chemically neutralize it and thus decrease irritation of the inflamed mucosa and so to flush the pus from the urethra under Nature's own pressure and thus to help her in the effort to cast off the disease by the pus.

Alcoholics in all forms are forbidden, because alcohol in the urine violently inflames the disease exactly as it pains and burns a raw surface. The average drinker of alcohol takes considerably more than his body will consume as food and cast from itself in altered form. He therefore has a certain quantity of unaltered alcohol in his blood and urine. It is this percentage which causes the difficulty.

**Tobacco.**—It is doubtful whether the use of tobacco except in great excess has any influence on the infection. Such excess, however, by depreciating resistance may add to the severity of the attack.

**Nursing.**—Unless the patient is put to bed, nursing during the acute period is not a factor except within the limit of the patient's own care.

of himself. The severe complications, however, such as those of the prostate, testicles, bladder, kidneys or extragenital organs, especially the eye, require the most expert nurses. None but those trained in this service should be employed. Manifestly the male nurse fulfils one of his best fields in this regard for the male subject. Female nurses may be trained to do it very well but have the difficulty of not infrequently offering subconsciously sexual stimulation.

**Dressings.**—The form of dressing is fully discussed in the paragraph of acute inflammation in both sexes. The cotton plug which imprisons the discharge within the urethra of the male or within the urethra and the vagina of the female is folly, because it checks Nature's first effort at cure, which is the discharge. The apron dressing for the male and the so-called gonorrheal bag, loosely fitted, are the only wise dressings, and similarly a soft vulvar pad or towel loosely applied in the female. The surgeon does not block up the discharging sinus of a healing wound, but encourages it to drain itself clean from hour to hour. The urologist should follow the same rule and should not block up the urethra in the male or female which in a broad sense are sinuses when infected or put a plug into the vagina which in a similar sense is a wound cavity when infected. The drainage of these parts free of gonococcal pus should not be hindered by faulty dressings any more than the development of the pus should be stimulated by erroneous treatment.

Further details concerning management in each gonococcal affection are mentioned in the paragraphs on its treatment.

### PHYSICAL MEASURES.

**Varieties.**—The four common physical forms of treatment are available in the proper cases and stages of gonococcal disease and are massage, hydrotherapy, local or general, heliotherapy and electrotherapy, local or general.

**Purposes.**—The fact is that many of the other forms of treatment affect only the surface of the mucous membrane where it is reached by application, instillation, injection, irrigation or instrumentation. This is the reason that physical measures which through their profound influence on the circulation of the blood, on the secretion of glandular elements and on an organ more or less as a whole, become of special value when the disease has extended beyond the surface of the mucosa and is no longer benefited by the other steps. Manifestly these physical measures are advisable in the late subacute and chronic stages and are forbidden in the acute periods.

**Massage.—Forms.**—Massage is employed in urological work either with the finger or with an instrument, either attached to the finger or held in the hand. It is almost needless to say that digital massage alone is advisable because it permits the finger first to detect the chief point of the disease requiring stimulation and second to observe the effect of the treatment. Moreover, it brings the normally elastic tissue of the finger into contact with a diseased and perhaps badly damaged gland

so that the perception of the surgeon matches that of the patient, avoiding violence and secondary injury. On the other hand, an instrument attached to the finger or held in the hand for manipulation of the finger or hand, or one electrically driven, is bereft of all these advantages and should never be used.

**Purposes.**—To stimulate the circulation of the blood in subacute and chronic inflammation is the chief aim of massage so that healing will be accomplished as rapidly as possible. Equally important is the evacuation of unhealthy retained secretion or pus-pockets and sinuses.

**Selection of Case.**—From the foregoing facts it follows that glandular involvements or complications, especially those in the glands of Cowper, the prostate and the seminal vesicles offer the best field for this treatment. Only the late subacute and the chronic periods are those in which the massage should be employed. If there is obstruction of the ducts of the glands of Cowper or the seminal vesicle or if a cyst or abscess is present, massage should be attempted with caution and immediately abandoned in case of failure of evacuation of the accumulation, otherwise persistence in this treatment will extend the infection to outlying connective tissue, as a complication.

**Technic.**—The method of performing massage with reference to special indications is found in the paragraphs on the treatment of lesions to which it may be applied in the Chapters on Chronic Urethritis and on the Complications of Urethritis.

**Hydrotherapy.**—**Varieties.**—Water may be applied in the treatment of gonococcal disease as a local and as a general measure. Its effects are really thermal, through heat and cold, with their influence on circulation.

**Purposes.**—Changes in the circulation during the inflammation are the aims of hydrotherapy in the strict sense, although mechanical removal of exudate may also be part of this subject through irrigations and injections. Unlike massage and electrotherapy, hot or cold water may be used during the acute as well as the chronic period. Thus the congestion and discharge of the early days are benefited usually by cold and often by heat and the indolence of the later stage is removed usually by heat.

**Selection of Case.**—The question is chiefly the comfort of the patient and the results of the method. Some individuals do better under cold applications while still others are relieved by heat. As a rule, cold is best in the acute period when the forced circulation of the early inflammation needs quieting. The later conditions call for heat in order to draw blood into the sluggish vessels of chronic inflammation. The patient is, however, a law to himself.

In the local application are considered irrigations of the prepuce of the urethra, bladder and rectum in the male and the vagina also in the female. Penile baths must be included, likewise double-current rectal tubes and the psychrophore. The sitting bath is a powerful decongestant when properly taken. A special tub for this purpose is

venient but not essential, because the patient may draw ten or twelve inches of very hot water in his tub and sit therein with his lower extremities extended. The water should make the skin red with heat, the bath should continue for from twenty to thirty minutes and the patient immediately returns to bed. Such a bath draws the blood directly away from infected internal organ in both sexes. In the general applications are included various medicinal baths and Turkish or Russian baths for their eliminative and tonic effects. They are available for the chronic cases with absorption as typified by any systemic complication and notably arthritis. If not of definitely good result they had best be discontinued.

**Technic.**—The special methods of applying the irrigations, the local baths and the general baths are either described in the paragraphs on the treatment of the lesions appropriate for them or are so familiar as to need no comment here.

**Heliotherapy.**—**Definition.**—The application of light to disease is known as heliotherapy and with the modern means of the electrical development of light, both incandescent and arc, is efficient and serviceable.

**Varieties.**—Incandescent, arc, white and colored, are the usual varieties and the most convenient form for the urologist is the so-called therapeutic lamp. It consists briefly of a deep parabolic reflector completely covering and protecting a 50-candlepower lamp, a handle and the necessary cable and connector.

**Action.**—The intensity of the light is thermal, actinic and biochemical. The thermal influence is reached by applying the light until the skin is very red, exactly as in hydrotherapy. Actinic energy probably rests in the ultraviolet rays, and biochemistry is probably both the heat and the actinic action combined. The local temperature is raised, and resistance to the organisms increased and a profound influence developed on absorption and resorption. The circulation of the skin and subcutaneous tissue is excited, deep organs are decongested as in hydrotherapy with greater convenience of application. Heliotherapy is available in all acute lesions of the deep organs and in any chronic cases with a tendency to exacerbation.

**Selection of Case.**—Heliotherapy is advisable wherever the deep organs are infected and will be benefited by the application of heat, as in the complications of prostatitis, seminal vesiculitis, cowperitis, salpingitis and oöphoritis; deeply seated lesions are benefited by the decongestion and superficial lesions by actinic and biochemical action. In short, it is available wherever hydrotherapy is.

**Technic.**—The therapeutic lamp and the details of its application are fully discussed in the paragraphs on treatment of each lesion as it arises in the Chapter on Complications of Acute Urethritis.

**Electrotherapy.**—**Status.**—This contribution is not a brief in behalf of or an apology for electrotherapy. Adverse critics obviously either have no equipment at all or one that is deficient. They therefore have not had the experience which makes their opinion reliable or final.

It is a poor argument to say that other methods will do as well or as much. It is our function to be skilled in all methods available, because in such infections of the mucosa as the gonococcal, in many cases the wider the variety and the greater the graduations of treatment the better the results. Electrotherapy succeeds where other methods fail; its graduations are exact, its idiosyncrasies are unknown and there are no unfavorable reactions if the form and intensity of the current, the duration and the frequency of treatments and the aftercare of the patient are all correctly selected and carried out. There must be no error in the exact diagnosis of the disease. It is peculiar that so many other forms of electrotherapeutics are not universally recognized by urologists while they employ so widely this treatment in the currents of Oudin and d'Arsonval. This situation undoubtedly arises from the fact that the methods of applying the latter two modalities have been studied and refined while those of employing other forms have been neglected.

**Varieties.**—Electricity is in local or general applications and is further distinguished by the form of current. The local types are urethral, rectal and abdominal. The kinds of current are galvanic or direct, faradic or induced, static or frictional, Oudin or unipolar high frequency, d'Arsonval or bipolar high frequency and diathermy, which is the direct application of the d'Arsonval current. In urology faradism is comparatively little used.

**Action.**—The physiological activities evoked differ greatly with the various currents applied as discussed under each in the following paragraphs.

**Galvanism or the Direct Current.**—*Action.*—In galvanism or the direct current the chief value is cataphoresis. The current is electrolytic to metal electrodes and therefore deposits in the tissues oxychloride of the metal used when the positive pole is applied to the diseased tissue. When the negative pole is used the alkalies, alkaloids and the halogen group should be added. The chemical strength of these medicaments is always very weak and that of the galvanic current varies from 3 to 5 milliampères and so rarely more as to be at least for the novice never more.

The positive pole contracts and stimulates and the negative pole of galvanism relaxes and quiets. In spasm, therefore, of the urethra, for example after using the positive pole, the negative current should be turned on in the same strength and for the same duration or until the contraction relaxes.

**Indications.**—Galvanism is serviceable wherever a deposit of astringent and stimulating medicament is required for the tissues. There should be no unfavorable aftereffects.

**Faradism of the Induced Current.**—*Action.*—In faradism or the induced current the muscle substance is stimulated and for good results the contraction must correspond with the rapidity of muscular fibrillation, which is 30 per second.

**Indications.**—Faradism is indicated whenever there is relaxation of muscular or other tissue. Exhaustion should not be an aftereffect.

**Oudin or the Unipolar High-Frequency Current.**—*Action.*—The Oudin or the unipolar high-frequency current has its effects according to the spark-gap, from drying to charring.

*Test.*—The best test is with a piece of soap, as follows:

1. Take a piece of dry ivory soap and adjust the spark-gap so that the soap is dehydrated. It then puffs up into a dry, fine, white powder. It should not be discolored or charred.

2. If in doubt, cover the soap with a piece of paper, which will burn if the spark is too hot, otherwise it will permit the spark to jump through it without damage to the paper and with dehydration of the soap.

3. For caustic effect increase the spark-gap until the soap bubbles and coagulates but does not char.

4. For carbonization the spark-gap is increased until the soap is coagulated and then blackened by charring.

*Indications.*—The graduations in the strength of this current are by this test absolute and make it available for the stimulation and healing of ulcers or the carbonization of new growths. The electrode with its wire slightly projecting will destroy and then permit to heal diseased follicles of the paraurethral, periurethral, urethral, preputial and vesicle in either sex by insertion into the cavity of the follicle.

*Aftereffects.*—There is no cicatrix of the deep infiltrating type as after incision and the galvano or the actual cautery.

**D'Arsonval or Bipolar High-Frequency or Alternating Current.**—*Action.*—The d'Arsonval current causes direct diathermy and also indirect diathermy with an autocondensation couch as the dispersing electrode. This method is the one employed for dilating stricture of the ureter or urethra.

*Strength.*—The current should be from 100 to 200 milliampères and without pain. More than a gentle tingling is not desirable. The test is for the operator himself to get upon the autocondensation couch and to apply the active electrode to the tongue, which should feel a painless glow.

*Indications.*—Infiltrations and strictures, the urethra and ureter by indirect diathermy, and by direct diathermy it is available in local inflammations.

**Diathermy.**—*Origin.*—The bipolar high-frequency current of d'Arsonval causes diathermy, which is briefly a heat influence.

*Forms.*—Direct diathermy if when soft, malleable, metal electrodes are applied to opposite sides of the part as the knee, or when an organ like the penis is wrapped in such an electrode. Careful apposition of the metal to the skin is essential in order to avoid burns which are difficult to heal.

The indirect diathermy is secured when the active electrode is applied to the affected part with distribution of the current through the whole body by having the autocondensation couch act as the dispersing electrode.



*Indications.*—Any acute or subacute infection which will be benefited by the local increase of temperature and leukocytosis, and phagocytosis for combating and destroying the organisms.

A review of literature contains many observations.

De Kraft<sup>1</sup> reviews diathermy as follows. Roccayrol<sup>2</sup> employed diathermy in chronic urethritis with special thermophores. The gonococcus was killed at 39° C. in twenty minutes. The thermophores in the urethra are connected to one side of the diathermy machine. The other electrode (metallic plate) is placed on the buttocks, penis or perineum. In 44 cases he variously relieved pain, shreds, soft infiltrations and trophic changes.

Geyser<sup>3</sup> applying steel sounds as urethral electrodes and temperatures around 108° F. with diathermy for one hour daily for three days killed the gonococcus. Eitner<sup>4</sup> found that gonococci disappear in acute urethritis after a time under diathermy for forty minutes twice daily. The urine remained cloudy and after cessation of treatment the organisms returned, but the measures removed subjective symptoms. Santos<sup>5</sup> showed that gonococci die in seventy-six minutes at 43° C., in fifty-four minutes at 44° C. and in thirty-seven minutes at 45° C., and that animals and human beings can bear a temperature of 45° C. and even 46° C., for one hour without discomfort or damage. After many trials and with much difficulty he constructed an electrode which heated the urethra throughout and sterilized a gonorrhea of several weeks' duration in a single ninety-minute sitting. In a second case a second treatment cured. In three other cases no result could be achieved.

Ballenger and Elder<sup>6</sup> devised a ball electrode for the d'Arsonva current in folliculitis. Kaufman<sup>7</sup> urethroscopes carefully. The electrode is inserted into the follicle up to definite resistance. The current is then turned on for one second. Usually two or three one second periods cure. The results were excellent in 5 cases.

De Kraft<sup>8</sup> himself has treated spasmodic strictures with an ordinal sound as one electrode, and a wrapping of tin-foil on the penis as the other electrode. Neurasthenia depending on a chronic congestive prostatitis may be relieved by a metallic prostatic electrode in the rectum, connected to one pole of the diathermic apparatus; while metal plate above the symphysis is attached to the other pole. Indurations are benefited by diathermy through a metallic sound from within and a flexible tin-foil electrode on the outer surface of the organ. Incontinence in older men in atony of the sphincter or in the chronic vesical irritation of diabetes mellitus is decreased by diathermy through

<sup>1</sup> Am. Jour. Electrother. and Radiol., November, 1917.

<sup>2</sup> Bull. de l'Académie de Médecine, May 22, 1917.

<sup>3</sup> New York Med. Jour., June 30, 1917.

<sup>4</sup> Jour. Adv. Therap., March, 1917.

<sup>5</sup> In Boerner and Santos: Med. Klinik, June 21, 1914, x, 1062.

<sup>6</sup> Jour. Am. Med. Assn., May 27, 1916.

<sup>7</sup> New York Med. Jour., March 24, 1917.

<sup>8</sup> Loc. cit.

metallic electrode in the rectum and metal plate over the bladder. Canovas<sup>1</sup> applied diathermy in 73 cases of gonococcic orchitis and epididymitis. It surpasses all other methods. It relieves pain at once and cures in three or four applications. The diathermy reduces inflammation and kills the gonococci. The genital functions remain unimpaired.

It therefore appears from all the foregoing studies that diathermy possesses a wide field of development.

### MEDICINAL MEASURES.

**Classification.**—Selection of medicines in gonococcal as in other infections depends on the stages of the disease, acute, subacute and chronic and on the presence or absence of complications. It further varies with the methods of local application and systemic administration, which include orrhoterapy.

**Acute Stage.**—In the acute period are indicated sedatives, urinary diluents, neutralizers and antiseptics and antiblemnorrhagics, because the mucosa is violently inflamed and its secretion profoundly altered.

Acting by systemic administration after absorption into the blood, the sedatives quiet the congestion and the irritation by their direct antispasmodic influence. The belladonna group and the opium group are the most reliable examples. By diluting and neutralizing the urine the inflammation is also quieted so that among the sedatives should be classed the urinary diluents and neutralizers. The ordinary alkalies, mineral waters and even plain table water are of service. Except for infections in closed cavities like the pelvis of the kidney and the bladder the urinary antiseptics have little or no value. Under this heading belong the drugs which produce formaldehyde by being split up in the body. Hexamethylenamin and its allies are most familiar and act best when combined with equal quantities of benzoate of soda.

Acting by topical application to the mucosa a sedative and decongestive influence is seen by the heat of sitting baths and of properly selected irrigation of normal salt solution and if the fluid is also antiseptic, such as potassium permanganate, argyrol or other silver salts, the infection as such is combated. The latter influence belongs to hand injections because their quantity is usually not sufficient to make their heat of value. The aim is not to flare up the inflammation, but to correct it by heat within tolerance, by mild strengths, by copious quantities within common sense, by frequency according to response, by retention for a full influence of heat and drug and by gentleness of application, so that the syringe-and-catheter method is to be preferred to the irrigator method. All these details are elucidated in the paragraphs on hand injections and irrigations in the Chapter on Acute Urethritis on pages 61 to 64.

The antiblemnorrhagics are of value in some acute cases and they com-

<sup>1</sup> Diag. Med., June 30, 1917.

prise the balsams and the oils and the oleoresins. Their action is by stimulating an indolent mucosa to a proper degree and quality of secretion. Their list is a long one but familiar are copaiba, cubeb, sandalwood oil and oil of turpentine. Gomenol oil is a new product of great service especially in kidney and bladder conditions. The doses of all these products must not irritate the digestion or the kidneys, as respectively indicated by eructations and anorexia as to the stomach and by pain or frequency of urination as to the kidneys.

**Chronic Stage.**—In this period the mucosa is infiltrated, relaxed and inactive. Its secretion is thick and unnatural. Stimulants, antiseptics and astringents are required.

The stimulants by internal administration are again chiefly the oils, balsams, resins and oleoresins. These reach their greatest value in chronic instead of acute lesions. The doses are mild and increasing according to the modification of the mucus. They must, as just stated, not irritate the kidneys or the digestion. Combinations of several of these drugs in small doses are therapeutically more valuable and practically without aftereffects.

By local administration the effects of antiseptics and astringents are sought. They increase the blood flow and correct the boggy granulations and indolence.

The antiseptics by internal administration purify the urine, but as stated in the paragraph on the acute period they are of more value in infections of the kidney, pelvis, ureter and bladder. It is doubtful whether the mere bathing of the mucosa of the urethra has any influence, although the urine is strongly antiseptic.

By local administration the antiseptics are available in injections, irrigations, instillations and applications. Of these the last two are of greatest value because a small quantity of relatively strong fluid is as far as possible applied directly to the diseased zone.

The astringents are mineral or vegetable. At least the early strengths are weak and are slowly augmented. There must be no overstimulation, reaction, pain or great exfoliation of epithelia. Relatively frequent repetition and long retention are to be preferred to the stronger concentration. The mineral astringents are much the best and the common three are the salts of silver, zinc and copper. It is probable that nitrate of silver which is ranked as the most astringent, the least irritating and the least caustic is the best and that a proper strength of it for each patient can always be found. The vegetable astringents are of much less value through superficial action.

**Systemic Administration.**—The aims of this form of treatment are to influence the activity of the local circulation in the inflammation by changes in the whole system through the condition of the blood-stream itself, the urine and the nervous system. Circulatory sedatives are therefore in order, while stimulation is avoided—through coffee, tea, cocoa and more particularly alcoholics, among the common drugs. Physiological influence is equally important so that direct and indirect sexual excitement must be forbidden. It is in these details that the

coöperation of the patient is so important, but difficult and at times impossible to obtain. The minute principles of systemic administration and allied topics are laid down in the treatment of each lesion in the chapters on Acute Urethritis, Chronic Urethritis and Complications.

In serumtherapy we approach a subject of modern knowledge and great importance. It is discussed in the sections on serum-diagnosis and serumtherapy in Chapter VIII on General Principles of Diagnosis on page 475. Under this heading are included administration of serum and bacterin. Of the latter there are two general classes: the autogenous as derived from the patient's own infecting organisms, and heterogenous as obtained from other sources. Either or both may be a pure culture of the gonococcus alone or of this organism combined with many other pus-producing germs. The latter preparations are known as the mixed or combined bacterins. In general, persistent treatment with the serum or the bacterin is necessary in gonococcal infections and on the whole this therapy is less efficient in gonococcal than in other diseases.

**Local Administration.**—This method of treatment affects in the male the prepuce, glans, meatus, urethra, bladder, ureters and kidneys. Accessible in the female are the vulva, vagina, cervix and cavity of the uterus, as well as the urethra, bladder, ureters and kidneys. The urethral methods in both sexes are irrigations, retrojections, injections, instillations and applications in the technics already described in the paragraphs on the treatment of appropriate lesions. The urethroscope and cystoscope are means of modern and approved treatment which must never be overlooked in this field of cure. The rule should again be repeated that mild solutions applied at relatively short intervals and as far as possible retained for long periods are more efficient and reliable than strong medicaments applied at long intervals and not at all retained. The latter are very apt to cause a chemical inflammation which adds to any infection present.

The ureteral and renal steps are those of the cystoscope, ureteral catheterization, pelvic lavage and instillation. The latter two methods may also be applied to the ureter. One cannot repeat here the technic described under the proper headings in the chapters on Urethroscopy and Cystoscopy on pages 616 and 682; but the rule of gentleness just reiterated in the preceding paragraph applies with equal and added force and particularly bears on the detail of not offending the mucosa by undue dilatation of the pelvis or ureter.

For vaginal methods the various specula, such as Sims', Ferguson's, and the bivalve and the various douches, are available. The mucosa of the vagina is much more resistant than that of other parts of the genital track so that stronger and hotter solution may be advisedly used but never with severe reaction which would intensify the infection.

In the uterine technic mild cautious douches may be employed, always provided that there is free outlet and no obstruction to the return flow, so that retention would follow with extension to the tubes. The oviducts should not be invaded with fluids by methods at present

available. Applications on cotton-wound wire sounds with small quantities of stronger medicaments may be employed. In the vagina and the uterus, as in all other mucous membranes, mild frequent treatments are better than severe infrequent attempts because the latter are often followed by intense reactions and extensions of the disease, whereas the former are not. The great caution in the uterus must be good drainage, weak solutions and slow ascent in strength. Frequency and persistence rather than rare and irregular attention are required.

### SURGICAL MEASURES.

**Classification.**—Nonoperative and operative procedures are distinguished under the heading of surgical measures, which include more or less definite instrumentation even when no actual cutting is done.

**Nonoperative Means.**—These include dressings, catheterization, urethral irrigation, urethral instillations, urethral retrojections, hand injections, straight sounds, irrigating sounds, instilling sounds, mechanical dilators and ointment sounds.

The dressings are penile, preputial and vulvar so far as urethritis and allied conditions are concerned and therefore the description excludes the dressings of the major operations, under which they are described. The object of dressings is to receive the discharge, as voided, keep the skin and clothing clean and prevent mediate infection of the eyes of the patient and the eyes of innocent persons or their sexual systems. Their purpose is distinctly not to retain discharge, as such retention extends the infection. In the male the penile gauze bag or the gauze hood as explained in the paragraphs on the treatment of acute urethritis on page 55 is available. The hood is the preputial dressing in balanitis and similar complications. A cotton plug over the meatus within the foreskin bottles up the discharge, extends the inflammation in depth and along the urethra and is contraindicated. Likewise the plug of cotton in the cleft of the vulva in the female, which should be supplanted by the loose gauze pad. All dressings should be frequently changed and retention if present relieved by urination, irrigation, hand injection or douche.

No catheterization should be attempted in acute lesions of the urethra except anterior irrigation with a very small catheter in the syringe-and-catheter method. It is likewise contraindicated in chronic urethritis with positive infection unless irrigation of both bladder and urethra follows. In fact, it is best to irrigate these parts after any instrumentation. Catheterization with small soft instruments may be gently attempted in acute retention but must not be persisted in more than one or two invasions. Irrigation of the bladder and canal must follow. The best antiseptic solution is silver nitrate, 1 to 5000 to 1 to 2000, in reasonably hot water. The forms of catheter are well known to every skilled urologist. The soft-rubber instruments are better the nearer the acute period the lesion is and they must be new, elastic and smooth. Rubber hardens, dries and cracks with age with result-

ing inelasticity, roughness and irritation. The woven catheters are better in the later periods because they improve treatment by their various forms selected according to the case. Their surfaces must also be without cracks. The storing, care and sterilization of these instruments are described for the more important varieties. Good lubrication is necessary and the author thinks that glyceritum boroglycerini or any of the soft Irish moss preparations is the best. It is certain that these are soluble in water and do not coat the mucosa so that applications lose their penetrating power.

The urethral irrigations are performed by the manual or the gravity methods. The syringe-and-catheter method is the choice of the author, because it is the most gentle and precise and permits the educated hand to perceive how much resistance is encountered and how much pressure the mucosa will tolerate. The gravity technics are represented by the Chetwood double-current and the Valentine-Janet equipments. Of these the Chetwood is the choice of the author although both have their strong advocates. In general the pressure of the fluid must not be greater than that of the urine as it passes through the canal. This rule avoids traumatism of the severely inflamed mucosa. These procedures are detailed in appropriate paragraphs on treatment of Acute and Chronic Urethritis on pages 64 and 282. It is noted that irrigations apply to copious quantities and the rather earlier periods of the disease in which flushing with a mild concentration of chemical is in order. They may be given once or twice daily and as adjuvants the hand injection is important.

The urethral instillations are otherwise employed with small quantities of much stronger solutions and in the late subacute and chronic periods. Both the anterior and the posterior urethra may be reached by this method. In the author's judgment the soft-rubber catheters, size 10 or 12 F., 6 inches long with a 4 drachm syringe of the Hayden type or the author's modification of it, are the best for the anterior urethra. In the posterior urethra the soft-rubber catheter may again be employed but with less satisfaction than the syringe of Keyes's modification of the original Ultzmann type or still better the Bangs syringe sound, which in having a full set of tips adds gentle dilatation to the medication. Again nitrate of silver is the best for the average case. No strength should be selected which causes chemical inflammation. From weak solutions such as 1 to 5000 with which the treatments begin, ascent should be gradual and its results closely observed. Under the subject of the treatment of lesions will be found the details of the instruments, technic and solutions. Every other day is the proper interval and dilatation with sounds and electrotherapy are usual adjuvants.

The urethral retrojections involve the use of a reflux catheter or the filling of the bladder with the solution which the patient voids as though it were urine. The varieties of reflux catheter are familiar and their use is cautious. The method of filling the bladder is to be preferred and inasmuch as cases requiring retrojections are also bene-

fited by dilatations, the author's irrigating sounds are the best possible method of combining both treatments. The sound is described on page 368 and retrojections with its aid are fully noted under dilatation of stricture on page 379. Again the rule applies of using fluids hot within tolerance, copious within comfort and concentrated within any reaction. Frequency with the soft catheter may be every other day and with the sound every five, seven or ten days. Instillations are good alternates.

The hand injection is applied by the patient himself according to printed directions in order to avoid excesses in frequency, activity or force. The proper syringe is very important and the best types are shown on page 49. Care should be taken that the patient secures the cone-point urethral type and not such forms as the druggist may supply. The author has seen nose, ear and even rectal syringes sold to patients. The instructions to patients, the list of solutions, the period of choice for injections are all presented in the paragraphs on treatment of Acute Urethritis on page 72. According to reaction the patient uses from two to six injections daily. Antiseptic solutions gradually give way to astringents.

The straight sounds introduce the subject of instrumentation of the urethra for dilatation and massage of the mucosa. The standard sounds passed only to the bulb of the urethra will thus treat the anterior section of the canal but the straight sound as shown on page 284 is much to be preferred. These instruments should never be used while infection is present but only when the catarrhal period is developed and when massage along the canal upon the sound stimulates the indolent membrane. The dilatation should never be more than one or possibly two numbers of the French scale at each treatment, and the frequency of treatments should be about once in seven days, rarely once in five days and sometimes once in ten days. Greater energy of treatment may defeat its purpose and make it harmful. The sounds are best used cold.

The irrigating and instillating sounds have already been sufficiently noted under retrojections and posterior urethral instillations in paragraphs immediately preceding. All further facts are found in the paragraphs on the use of sounds for treatment of Chronic Urethritis and Stricture on pages 287 and 365.

The mechanical dilators have long been considered instruments of danger. They become such only when the degree of dilatation is greater than one or possibly two numbers of the French scale at a sitting and when the frequency exceeds the five-day interval as the shortest. The irrigating and nonirrigating types are in common use as detailed under the treatment of Chronic Urethritis and Stricture.

The ointment sounds vary between the cupped sound carrying the ointment in the recesses and the tubular which express the ointment in mass at any point of the canal. The urethra reacts to the ointment as to a foreign body and expresses practically all of it. The remainder is not absorbed to any serviceable degree. The ointment sound of



the author, as shown on page 295, is the best model and permits the medicine to be applied to given points. The formulæ of the ointments and the frequency of application are detailed in the paragraphs on treatment.

**Operative Measures.**—Under this heading are included the more definite procedures which may or may not require local anesthetics and may or may not involve incisions. The list includes urethroscopy, cystoscopy, catheterization of the ureters, urinary segregation, minor operations and major operations. All such technic should have foretreatment and aftertreatment as the means of preventing unfavorable reaction or of checking it at its earliest possible signs.

The sciences of urethroscopy and cystoscopy are so definite that each is considered as separate subjects in Chapters XII and XIII.

The catheterization of the ureters is one of the procedures belonging to cystoscopy and may be so safely performed that it should be a routine examination in every case of unexplained blood, pus, gravel or other signs in the urine or of pain anywhere in the abdomen not otherwise explained. The shadow catheter is the one means of making the x-ray findings unmistakable in cases of suspected stone. There are twenty-one shadows which have been mistaken for stones in the pelvis or ureter and their list is given in the section on Lithiasis of the Kidney on page 923. Other data of this subject are given under Cystoscopy on page 682.

The urinary segregators aim to separate the urine from the two kidneys while being collected in the bladder. The only serviceable ones are Harris's, Cathelin's and Luys's. The general principle of each erects a median dam in the bladder between the two ureters and provides an outlet for each half of the viscus thus formed. Color tests show that often the two sides leak, so that a definite diagnosis cannot be relied on. Of the three mentioned the Luys instrument is the best and is discussed under Cystoscopy on page 704. When compared with ureteral catheterization the segregator is a very unsatisfactory instrument.

The minor operations are in general those that are solely or chiefly done under local anesthesia, although the modern technic of infiltration of the skin, fascia and muscle planes with dilute cocaine solution and spinal injections of cocaine derivatives, have made many operations come within the reach of local anesthetics. The minor operations as a rule do not require the forecare as to the bowels by catharsis and starvation, but the same rigid asepsis and antisepsis are necessary. In the gonococcal lesions the minor operations are superficial and include circumcision, meatotomy and adenotomy as examples. Aftertreatment is usually concerned only with dressings.

The major operations are characterized by forecare often for long periods as well as the day before the operation, by general anesthetics and by invasion of the important organs, such as the kidneys, ureters and bladder. The aftercare of these cases includes not only the dressings of the field but also attention to the urinary system as a whole.

**Aftertreatment.**—This is a subject entirely too much neglected in the average text-book, article in literature or discussion in medical societies. It comprises both immediate and remote aftercare. The immediate aftertreatment is that of the wound in dressings, of the urinary organs under the surgical interference, and of the system in general in the recovery. The dressings may persist for many weeks but the other details involve a few days of attention to the excretion of urine in quantity and quality, and freedom from obstruction of outflow as in kidney, ureteral and bladder work. The system at large during the first few days must relieve the kidneys in many cases through the bowels and the skin.

The remote aftertreatment aids the diseased organ to recover from the lesion as far as possible after the initial aid afforded by the operation. The best example is care of the bladder to relieve the cystitis accompanying enlargement of the prostate, lithiasis and malignant neoplasm. Pyelitis often requires drainage through the loin and is a disease analogous to cystitis in the long attention necessary to the mucosa through the urinary antiseptics, proper diet and gentle lavage of the pelvis and ureter.

**Cure.**—The relief of a disease is pathologic, symptomatic and bacteriologic and the term cure may be used somewhat similarly to prognosis. The lesions of gonococcal disease are so penetrating that the pathologic results are often not entirely remediable but the remaining lesions are so little that the patient is symptomatically cured. Stricture is an example of a pathologic sequel which as a cicatrix in the mucosa is never changed. The victim of stricture may have few or many symptoms and even directly fatal complications. The bacteriologic cure is for the community quite as important and in some respects more important than it is for the individual patient. The reason is that the gonococcus and its allies may reside in the mucosa for months and years with little inconvenience to the patient but with high infectiousness to the mate in wedlock. No man or woman should be allowed to marry after an infection until rigid and repeated laboratory investigations. A most important detail is the double examination of each sex in the quiescent and active states. This subject is more fully detailed under Prophylaxis on page 483.

#### TREATMENT OF THE COMPLICATIONS OF URETHRITIS.

**Varieties.**—Varieties are as previously described in this work the nongonococcal and the gonococcal, of which the latter is the established type to which the others are compared. Furthermore, complications are recognized as to extension anterior urethral and posterior urethral, as to course acute, subacute and chronic, as to distribution local and systemic and as to significance, minor and major. The complications of the anterior and posterior urethra must be separated because of individuality in anatomical relations and pathological types and under each the other classifications will be placed. It is to be remem-

ered that most acute complications become chronic and that thereafter chronic lesions may show exacerbations and relapses having all the features of new acute developments.

Local complications are divided into the urogenital group comprising the sexual and urinary forms and the systemic group containing chiefly systemic symptoms without true invasion of extragenital organs. Systemic complications catalogue lesions in the various organs of the systems attacked exactly as stated in the clinical portion of the subject.

Minor complications are of the foreskin and mucosa alone while the major complications compromise the various important sexual glands, the urinary system and the general system.

**General Consideration.**—General consideration implies that all complications are active processes and express rapidly extending involvement through virulence of infection or the transfer of lesions from instrumentation or errors on the part of the patient. They all require the same general plan of treatment especially the acute complications while the chronic foci are more individualized.

Preventive and abortive measures are not definite in general terms beyond the value of full comprehension of the lesions underlying the symptoms, good management, properly applied physical measures, suitably chosen systemic and local medicinal measures, avoidance of offense by surgical means, and above all abstinence from overtreatment. It is certain that proper treatment of the gonococcal urethritis not only tends to limit the onset of complications but also results in a less severe course, when they do occur. Due obedience to these principles tends to prevention while abortive treatment is in the nature of things not possible in the majority of the complications.

### **Treatment of Complications of Anterior Gonococcal Urethritis.**

**Urogenital Group.**—Sexual forms embrace the minor complications—phimosis, paraphimosis, balanitis, posthitis and balanoposthitis, lymphangitis and lymphadenitis, littritis and folliculitis in either acute or chronic forms and also the major complication cowperitis in its acute or chronic stage without or with occlusion. Urinary forms do not occur in the anterior urethra and likewise there is no systemic group in the strict sense.

**Extraurogenital or Systemic Group.—Significance.**—In general all are relatively more rare than the urogenital forms and almost all depend on systemic invasion except when direct contact of pus is obvious, as in the mucosa of the mouth, rectum and eye. In their relation to systemic invasion, therefore, they are all very important.

Prophylaxis is directly concerned with early care against the transfer of the pus to other surfaces embodied in the asepsis and antisepsis of the standard hygiene already described. Indirectly skillful management and treatment of the initial lesions avoid the complications and the absorption of their toxins and become preventive. Abortive measures cannot be assigned except in accessible surfaces such as the

mouth, rectum and eye, which should be sterilized at the foremost symptom of suspected infection.

General curative treatment is best in conservative and expectant forms and must reach the original focus of infection and absorption, otherwise failure will follow treatment of the systemic complication. The best example of this is persistence of arthritis until the causal seminal vesiculitis or prostatitis is relieved. Based on exact diagnosis of the lesions all the usual elements of management, physical measures, medicinal means and surgical procedures apply as previously stated.

### SEROTHERAPY OR ORRHOTHERAPY.

**Opsonic Index.—Basis.**—Orrhotherapy rests on the same principles as those already stated under orrhodiagnosis for immunity and anaphylaxis and will not be repeated. As previously shown opsonins are antibodies which act on the bacteria in an unknown way and which result in the destruction of the infecting organisms so that the white blood cells are more active in their phagocytosis.

Phagocytic count is the endeavor to estimate the number of organisms destroyed by the white blood cells and is made by taking the blood serum, white blood-cells and bacteria, mixing them together, incubating them for a definite time and then preparing smears. Differential stains are then made and the numbers of bacteria within the bodies of the white blood-cells in many microscopic fields are averaged to show the efficiency of the phagocytosis in terms of the ratio between the number of bacteria within the cells and that of the cells themselves.

Opsonic index is the ratio between the phagocytic counts in disease and in health and was regarded by Wright of London as a mathematical expression for the resistance of the patient to the disease. He endeavored to lay down the following broad principles as applied to this subject.

1. Phagocytic count is low during infection and high during health.
2. The ratio between these two counts or the opsonic index is specific in each disease.
3. The opsonic index is a measure of resistance of the patient to the specific disease.
4. The opsonic index is a diagnostic aid because specific, in being low during infection with a given disease, but remaining high at the same time for other diseases.

5. Immunity therefore raises anaphylaxis, lowers the opsonic index.

Many of these teachings have been abandoned as technically difficult and as clinically uncertain but the broad principles remain accepted. Clinical data are therefore naturally regarded as decisive in orrhotherapy and much more convenient than these difficult procedures.

**Negative and Positive Phase of Opsonic Index.**—The administration of bacterin or other bacterial product, like infection with the disease itself, lowers the opsonic index for a few days. This action is techni-

cally called the "negative phase," persists for about three days and is slowly followed by an increase in the index during the next succeeding days to a limit above the normal and known as the "positive phase." Additional dose of the bacterin or vaccine during the negative phase is, therefore, dangerous, so that subsequent inoculations in the production of active immunity should occur during the positive phase. These facts determine the policy of administering immunizing doses every five, six or seven days in accordance with the form of bacterial product used, the nature of the germ and the reaction of the patient to previous injections.

**Active Immunity.—Production of Active Immunity.**—Inoculation may be performed in man and in animals for immunization with active bacteria, inactive or dead bacteria and bacterial products or extracts. Active bacteria in full potency are never used in man but are reserved for animal experimentation only. In man, therefore, only attenuated or modified bacteria are applicable and the best examples are, of the former, inoculation against rabies, and, of the latter, vaccination against smallpox. On the other hand, immunization by dead bacteria is the rule in man and in preference the same strain is used as that found in specimens of exudate and pus taken from the patient. In this manner are produced autogenous bacterins or vaccines which in most subjects seem to have a greater valence for inducing immunity than do heterogeneous or stock bacterins or vaccines of organisms of the same type secured from laboratories.

**Gonococcal Bacterin or Vaccine.**—In gonococcal infection the difficulty of isolation of the individual strain is doubled by the large number of strains and by the great uncertainties of culturing the gonococcus. In this disease, therefore, it is often unavoidable that stock bacterin shall be used, but good results are obtained if the product is from a first-class laboratory where details of standardization are reliable. In no event can the practitioner himself prepare these products for the same reasons as were set forth briefly under the subject of Complement Fixation Test on page 476. It is necessary to order the laboratory doses of low strength first and from these advance to concentrated strength; for example, 50 million in 1 c.c. at first, gradually increased to 500 million in 1 c.c.

There are two forms of bacterin prepared from gonococcal cultures: one containing the gonococcus alone and the other, called combined bacterin, containing the gonococcus and the staphylococcus. The preparation of gonococcal bacterin is the same as that of all similar products, from cultures whose bacteriologic and physiologic characters are as carefully measured as possible, and then inactivated. The strength of such bacterin is in millions of dead bacteria in each cubic centimeter and it is convenient to employ those products which are marketed in a single dose container, or in hospital practice in larger containers from which suitable doses are taken by plunging the needle through the rubber cap of the bottle. The administration is either subcutaneous or intramuscular and the initial dose is 100,000,000 or

less slowly increasing to from 300,000,000 to 500,000,000 every two to three days—according to the disappearance of the negative phase. The preparation of gonococcal combined bacterin is the same with the addition of cultures of the *Staphylococcus albus*, *citreus* and *aureus*, so that there are 500,000,000 dead gonococci and 400,000,000 dead staphylococci in each cubic centimeter with 0.2 per cent. of trikresol as preservative. The administration is subcutaneous for the first dose and may thereafter be intramuscular if the local reaction has not been severe and the dose begins with from 0.2 to 0.5 c.c. and slowly ascends according to the activity of the disease and the condition and reaction of the patient, such as headache, malaise and feverishness which mark the negative phase. Subsequent doses are given from five to eight days apart thereafter or, if the reaction has not been marked, at shorter intervals.

**Technic of Inoculation.**—The hands of the surgeon, the skin of the patient and the needle and syringe are all fully sterilized. The best needle has a metal mounted glass barrel of 1 c.c. capacity, an expanding asbestos packed plunger on a heavy piston marked in tenths of 1 c.c. and surmounted with a large head for standing the syringe upright. The injections are made subcutaneously, as a rule, or intramuscularly, as the exception, and the dose may be as low as 2 or 3 million and as high as 300 to 500 million. Repetition of dose is not less than every three days and longer if the patient is disturbed. The three-day interval may be used in the smaller doses and the five- or seven-day interval in the larger doses. All these points rest on the form of infection, the condition of the patient, the reaction to each injection and the control of the symptoms. The selection of bacterin is important and rests on exact bacteriologic diagnosis. Autogenous gonococcal bacterin is difficult to secure as already stated so that standard stock products are the rule, and furthermore, a mixed vaccine in which the gonococcus and one or more of the pyogenic organisms are combined may be indicated because in many lesions the gonococcus alone is not present, particularly in rheumatism, so that a pure gonococcal bacterin will fail through omission of the associated organisms.

**Combined Bacterin of Van Cott**<sup>1</sup> and other mixed bacterins made of much the same organisms and having similar therapeutic indications and values deserve attention. Van Cott says: "The theory which led to this combination was, that it would be valuable in many cases where time was an element and autogenous vaccines impracticable and that if clinical experience of its use demonstrated that it could be safely used by the general practitioner with reasonable expectation of desired results such a polyvalent vaccine would find a wide sphere of usefulness." When facilities are not at hand for exact bacteriologic diagnosis, or when for technical difficulties the diagnosis is uncertain then any of these mixed bacterins is available. They are all more or less composed of the common pus-producing organisms, excepting the gono-

<sup>1</sup> New York State Jour. Med., July, 1911.

occus, and the so-called pyogenic group comprising the streptococci and the staphylococci are omitted from none. Different laboratories refer to add to these the *Bacillus coli communis*, the pneumococcus and the bacillus of diphtheria and others in various combinations but the formula of Van Cott has the preference. It consists of the following organisms:

c.c. contains	{	Streptococcus longus . . . . .	50,000,000
		Staphylococcus { aureus albus luteus citreus } . . . . .	500,000,000
		Bacillus coli communis . . . . .	200,000,000
		Total . . . . .	750,000,000

**Bacterial Products.**—Filtrates and extracts (phylacogens, Schafer<sup>1</sup>) are also of value in the induction of immunity and in orrhoterapy. As the term indicates, a filtrate is a culture from which the organisms have been removed by filtration and more or less loosely the term extract is also used, because such filtrate contains products of the organisms rather than the inactive organisms, as well as such products. One of the most typical and yet not of the most satisfactory application of such filtrate is that seen in tuberculosis, which may be discussed in this chapter on account of the lesions of this disease and their treatment described in the sections on Tuberculosis of the Bladder and Kidneys, pages 767 and 881. Filtrates are probably less potent than bacterins.

Gonococcal phylacogen or filtrate is a sterile aqueous solution of bacterial derivatives from cultures of the gonococcus in rather large proportion and in less proportion of other pathogenic bacteria, especially the *Streptococcus rheumaticus* (Poynton and Paine), *Streptococcus pyogenes*, *Streptococcus erysipelatis*, *Staphylococcus pyogenes*, *Bacillus pyocyaneus*, *Bacillus coli communis*, *Bacillus diphtheriæ*, and *Diplococcus pneumoniae*. Numerous strains of the several organisms from a variety of sources are employed. The basis of treatment rests on the facts that long-standing gonococcal infections are not simple with the gonococcus alone but complex with the presence of many organisms and that the latter may persist by themselves after the gonococcus has disappeared. The organisms themselves are filtered out of the preparation which is then carefully standardized as to absolute sterility and as to tolerance of test animals for it. The indications are chiefly the complications and sequels of chronic gonococcal urethritis as it is of less or little service in the acute disease. In the male, prostatitis, seminal vesiculitis, epididymitis and orchitis and in the female, vaginitis, cervicitis, endometritis, salpingitis and ovaritis and in both sexes cystitis, ureteritis and pyelitis and perhaps most important of all arthritis are benefited by its use—always combined with standard methods of treatment and never alone. The administration is either subcutaneous, intramuscular or intravenous. The former should

<sup>1</sup> Therap. Gaz., April 15, 1911.



always be the beginning of the treatment as a determinant of the patient's susceptibility and benefit and the latter is reserved for cases in which the former may not be sufficiently active. The subcutaneous dose begins with 1 c.c. and ascends to 5 or 10 c.c. unless the patient is debilitated, when half the usual quantity is advised. The course of the disease, the influence of this treatment upon it and the progress of the case determine the amount of dose and its frequency which is usually every two to three days. The intravenous dose is from 0.125 to 0.25 c.c. at first, followed by twice these quantities for the second and subsequent doses until the fourth dose is 1 c.c. Knowledge of the patient's susceptibility to phylacogen by the subcutaneous method is a preliminary of intravenous administration and dilution of the filtrate with warm normal salt solution is advantageous.

The technic of phylacogen administration is the same as that described for bacterins and vaccines in its preliminaries for the attendants, instruments and patient. The site of injection is subcutaneous, as a rule, and intramuscular or intravenous, as exceptional cases demand and the aim is to avoid the negative phase and to select the positive phase. The intervals of repetition of dose are determined according to the condition of the patient, the reaction, the persistence of the negative phase and the incidence of the positive phase, from clinical signs rather than from opsonic index. The size of dose is from 0.1 to 10 c.c. for the gonococcal filtrate and from 1 to 5 c.c. for the filtrate, with gradual ascent between these two limits. Intervals of doses are a fourth or a half of the subcutaneous quantity. The infection vaccine or filtrate obtained from proper culture, sterilization and mixture is secured from the *Staphylococcus aureus*, *Staphylococcus citreus*, *Streptococcus pyogenes*, *Pyocyanus* and *Erysipelatis*, *Coccus* and *Bacillus coli communis* and typhosus. After proper sterilization in suitable media the mixture is made and standardized as to concentration and the filtrate prepared for dose of standard degree. In this sense it is a "gunshot mixture," but has great value in infectious diseases whose precise bacteriologic features cannot be determined and whose causative organism may have disappeared; as examples, certain cases of tuberculosis and in chronic gonococcal complications are mentioned.

**Reaction and Dangers of Immunizing Doses** of bacterin and phylacogen are seen as local and systemic manifestations. On the whole the former, they are somewhat more active than in the latter. The local reactions are a swelling rarely advancing to infiltration, redness, sometimes with edema, and tenderness accompanied infrequently with pain. They disappear in from two to seven days and rarely require local sedative application. The purpose of strict asepsis and isolation is to eliminate the possibility of incidental infection and to make the local reaction purely that of the inoculation itself. The reaction really indicates the negative phase and manifests itself as chilliness or chill, feverishness or fever, anorexia or nausea and vomiting and a feeling of "being out of sorts" and irritability, sometimes actual malaise and depression. The more severe reactions

are the exceptions. Within twenty-four hours, as a rule, the patient feels well again and usually reports prompt onset of these symptoms within an hour or two of the dose but delayed onset sometimes occurs. If the administration is made in the late evening office hour and the patient sent home to bed, systemic reaction may not be perceived by him. The dangers of intravenous inoculation with mixed phylacogens or filtrates are real in their sudden severe reaction and sometimes fatal termination. The systemic symptoms are much more marked and the result is assumed to be more prompt than in either the subcutaneous or intramuscular method although it is difficult to see how a process so slow as immunity can be materially hastened. The technic is the same as that employed for subcutaneous and intramuscular inoculation with extraordinary precautions for asepsis and antisepsis in order to avoid extraneous infection. A fine hypodermic needle only is employed with clear lumen and unless the blood flow is a prompt free dripping, the needle must be proved to be in the vein by aspiration. After this the injection syringe is applied to it and the dose given, whose size is reduced to half or less than half the usual quantity (0.25 or 0.50 cubic centimeters). The injection must occupy several minutes so that a mass dose thrown into the blood is avoided. The dangers and disadvantages of this method and its results which up to the present are too little understood make it inadvisable for ordinary use.

**Passive Immunity.**—Production of passive immunity is efficient in protection against disease and differs from active immunity in not being natural in the sense that the subject produces it and in being artificial in the sense that the injected material contains the protective antibodies. The basis is, therefore, the injection into the animal to be immunized of a proper dose or number of doses of the serum of an animal fully immunized. It is available in patients who cannot produce natural immunity at all or with sufficient promptness or who are already infected with germs temporarily inert and therefore in need of protection at once. The best example of passive immunity is shown by diphtheritic antitoxin, which will protect the patient already infected and showing symptoms often against further progress of his disease and will immunize members of his family against progress to the active stages of an infection as yet inactive in the nose and throat. The results are ideally in all diseases the same as those in diphtheria but are not practically reached in many of them; nevertheless in gonococcal infections the results aimed at are the same.

**Antigonococcic Serum.**—Torrey<sup>1</sup> was the first to prepare and experiment with gonococcal serum originally from the blood of rams but lately from the blood of horses, which produces less untoward reaction. The animals are thoroughly immunized with gradually increasing dose of dead and living cultures of virulent gonococci, occasionally combined with gonococcic endotoxin. The collection of the blood, the separation of the serum and its preparation for market are the same as now

<sup>1</sup> Jour. Am. Med. Assn., September 14, 1907.

familiar in antidiphtheritic and other serums. Decomposition is prevented by 0.4 per cent. of trikresol, each stock of serum is tested in bulk bacteriologically and standardized physiologically and then distributed to bulbs which are hermetically sealed. Absolute standard cannot be adopted for serums but the activity of each lot is determined by specific immunity reactions, such as the complement fixation test. The indications of its use are regarded as: (1) direct extension into organs like the epididymis, testicle, prostate, seminal vesicles, fallopian tubes, bladder and kidneys—all from an active primary focus, and (2) entrance of the organisms or their toxins into the bloodstream directly or through the lymphatics indirectly, inducing such lesions as arthritis, iritis, endocarditis, pleuritis and meningitis. On the whole the serum is less efficient than the bacterin for reasons not fully understood but probably resident in cultural peculiarities of the gonococcus. Administration is by injection into the thighs, abdomen, buttocks or breasts after suitable preparation of the skin. Either the subcutaneous or the intramuscular route may be employed and always at slow rate in order to avoid pain and the tendency to severe local reaction. The doses commonly employed begin with 2 c.c. repeated every one to four days according to indications from the condition of the disease, the health and reaction of the patient to previous injections. The limit of dose is usually 10 c.c. which is reached by gradual increase from the initial dose. Corbus,<sup>1</sup> among other observers, recommends larger doses, 12 to 15 c.c. daily for three days up to a total of 36 or 45 c.c. The administration of serum does not exclude other measures of treatment and should in fact always be combined with them.

Gonococcal passive immunity is attempted and may be partially established in the acute stage having general or systemic absorption. The gonococcal serum is injected after having been secured from an immunized animal in slowly ascending doses at regular and rather short intervals beginning with 2 c.c., and ending with 10 c.c., every two or three days. A longer period of rest between administrations is said to invite anaphylaxis; in other words, the positive phase must be carefully observed for the administration. Gonococcal serobacterins, by which is meant a combination or mixture of the serum and bacterin, may be used in instituting passive immunity for the first few days. The reaction of the serum is believed to prepare the way for the influence of the bacterin, but may not be continued for longer than the first few administrations, two or three, and after this should be followed by the bacterin alone after the usual manner.

**Indications of Gonococcal Orrhodiagnosis; Orrhotherapy and Immunization.**—The general principles, as already indicated, apply to chronic rather than acute stages, to persistent rather than recent infections, to complicated rather than uncomplicated cases and to systemic rather than local symptoms. The essentials or preliminaries are careful bacteriological diagnosis of the infection by the gonococcus

<sup>1</sup> Jour. Am. Med. Assn., May 9, 1914.

and its associates and in this step cultures cannot be omitted. The gonococcal complement fixation test must be performed and, if positive, will in association with the bacteriologic decision become a guide to this kind of treatment and to the choice between serum and bacterin and phylacogen or a combination of them. Emphasis is laid on the fact that these laboratory products cannot be relied on alone in the treatment of these infections and that they can only be combined with recognized medical and surgical measures, such as are described in the special section devoted to each subject.

In general it should be remembered that in the acute stage of gonococcal urethritis in either sex the lesions are on the surface of the mucosa and, therefore, on the surface of the body in a strict sense although that surface is within a canal. This peculiarity distinguishes the infection from those which rapidly invade the bloodstream and the lymphstream and thereafter the body as a whole and renders the former somewhat more readily amenable to orrhodiagnosis and orrhoterapy than the latter. In gonococcal infections without complications of the anterior urethra, systemic absorption and symptoms are extremely rare and such as exist probably represent a temporary disturbance of the body such as is seen in all disease and not a general invasion. In posterior acute urethritis absorption is more apt to be a real factor even if there are no complications and when the latter supervene the element of systemic disturbance becomes important in both the acute and chronic forms of posterior urethritis.

Indications of gonococcal orrhoterapy may be classified as follows:

1. Acute complications, in both anterior and posterior disease, having severe local and systemic symptoms, as seen in the testis, epididymis, prostate in the male, tubes, ovaries and uterus in the female and bladder, ureters and kidneys in both sexes.
2. Chronic complications, having the same location and distribution as those just given for acute foci, and showing severe absorptive symptoms which are much more common than in the acute periods.
3. Systemic invasions, as exemplified in infarcts or metastases in the synovia of joints, bursæ and tendons and occasionally the pericardium and the endocardium. In this class may be placed peritoneal involvement in women, because of the identity of the membrane affected and not because peritonitis is metastatic.
4. Systemic absorption and toxemia with intense acute symptoms, usually from mixed infection and due to spread of the disease throughout the system.

**Gonococcal Acute and Chronic Urethritis without Complications.**—In early acute lesions, as already shown on pages 24 to 27, the gonococcus alone is the exciting element, whereas in the chronic lesions, also as previously described on page 265, the gonococcus is allied with the pyogenic organisms. The well-known laboratory peculiarities of the gonococcus and its superficial presence in the mucosa away from the influence of the bloodstreams and lymphstreams tend to make failures in orrhoterapy frequent, but in chronic lesions, where the penetration has been greater,

successes are more numerous, especially if the mixed bacterin or filtrate is used associated with the gonococcal preparations or subsequent to them. The gonococcus is apt to die within about three years, according to observations by Keyes,<sup>1</sup> but disease in the host may persist and infection of the opposite party in wedlock may occur, arising from the presence of the pyogenic organisms alone. On this fact rests the observation that in old urethritis the mixed bacterins and filtrates are alone worth while, in cases wherein the gonococcus cannot be isolated or demonstrated.

**Complications of Gonococcal Acute Urethritis,** whether recent or relapsing, all show slight systemic absorption in average cases, but in intense cases this element may be greater and yet never equal that seen in chronic lesions, no matter whether in either case the infection is pure or mixed. Directly proportional with the degree of systemic reaction is the advisability of applying the bacterin or serum treatment, which must never be begun without full bacteriologic and hematologic investigation. In general, where the gonococcus alone is present in the case, gonococcal bacterin, gonococcal serum and gonococcal phylacogen may be used, separately, serially or combined. The serum is probably the least serviceable and may be added to the bacterin for only the first few administrations. Autogenous bacterin and phylacogen should be first choice and may be followed by stock products if their influence seems deficient. Where the gonococcus is associated with pyogenic allies, bacterin and phylacogen derived from the gonococcus and the other organism may be used, provided the gonococcus is still present in obvious numbers, but if absent the mixed bacterin of Van Cott is advisable. Again the preference is for autogenous and not for stock preparations, except Van Cott's bacteria, which is essentially a laboratory product. To sum up, therefore, gonococci alone in the infection require their own laboratory products, but as they disappear from the patient, they should also be eliminated from the treatment and only those organisms used which are present. Pus accumulations into abscesses indicate surgical treatment and contraindicate orrhoterapy. The doses of these products have already been given and may be remembered as for the stronger preparations of serum and phylacogen as 5 c.c., as the largest dose and for the less potent products as 10 c.c., as the largest dose, while initial administrations are portions of these limits determined by the activity of the disease and the condition of the patient. The interval of dose is two or three days, rather a short than a long interval with great caution for the negative phase and careful observation for the appearance of focalized pus, in single or multiple abscesses.

**Complications of Gonococcal Chronic Urethritis.**—Specimens must be carefully studied for the form of infection present, determining the gonococcus alone or its associates. Such specimens must include discharge in the form of pus or shreds or scattered organisms in the

<sup>1</sup> Am. Jour. Med. Sc., 1912, cxliii, 107.

urine, and elements obtained from the seven-glass test of the author after careful massage of the prostate and seminal vesicles and semen secured in a condom. Full diagnosis is essential, and rests on physical examination to determine the parts or glands affected, on bacteriology to show the organisms individually or collectively present in the infection and to outline the results of previous treatment and on hematology to indicate the complement fixation test. The decision thus rendered determines the application of other treatment, the preparations of autogenous bacterins and filtrates and the selection of the product appropriate for the case. As in the acute infections, just stated, gonococcal bacterin, phylacogen and serum belong to the infections of pure gonococcal culture, and may be used alone, serially or combined, as autogenous or stock products. The mixed cases, however, demand a proper combination of the gonococcal with the allied infection and those in which the gonococcus cannot be determined receive the mixed bacterin of Van Cott. The doses are small in the beginning, slow in their ascent, should avoid the negative phase and respect only the positive phase and the intervals are usually three days. As stated under the acute complication 5 c.c. is the limit of strength for the stronger phylacogens and serums and twice this quantity for the weaker. Initial doses must remain well within these limits. The gonococcal bacterin may be begun with about 25,000,000 and increased to 500,000,000 if well borne but smaller doses are the rule, repeated every three to five days with longer intervals between the increases of strength of dose. The gonococcal phylacogen is administered in from 5 to 10 c.c. doses every one to three days and the gonococcal serum in from 2 to 10 c.c. every three days for a few times. All these applications rest on the condition of the patient, the state of his disease and his reaction to each application.

Gonococcal metastases or infarcts affect chiefly the synovial membrane of the joints, bursæ and tendons and may be classed under the general heading of gonococcal rheumatism which may, therefore, be arthritic, bursitic or myositic, typically or variously combined. A most important detail of this condition is treatment of the seminal vesicles, in which the majority of these cases arise as the focus of absorption. Other methods of treating joints, bursæ and muscles are necessary along with the application of the gonococcal products, bacterins, and phylacogen and serum. The bacterins are the most efficient and are administered in exactly the method, doses and precautions described under Complications of Gonococcal Chronic Urethritis on page 259. The frequency with which other bacteria occur in association with the gonococcus in all these cases makes it essential to use either the combined gonococcal bacterin or the mixed bacterin of Van Cott.

Gonococcal toxemia is seen sometimes in intense acute infection but more commonly in profound and mixed chronic complications. It presents the condition of absorption from one or more active through chronic foci of the bacterial products, rarely those of the gonococcus

alone but more frequently those of this organism allied with numerous pyogenic germs, exactly as in the case of gonococcal rheumatism, with which in fact toxemia is not infrequently associated. The presence of fever in these toxemias and other profound symptoms of more or less consistent presence during the attack make it difficult to determine where the negative phase of an inoculation ends and where the positive phase begins. With careful observation, however, bacterin and phylacogen may be employed in very small doses at intervals of three days or more, during which careful note of the reaction is kept.

**Contraindications.**—Contraindications of the administration of serum, bacterin and phylacogen are advanced circulatory and renal disease and general debility, so far as selection of this treatment in general is concerned, but so far as the repetition of dose is considered the presence of any systemic reaction marks the negative phase and forbids a subsequent dose until it has subsided and until the positive phase is, therefore, established.

By way of comparison and in respect for the great importance of urogenital tuberculosis a few words on its immunization are in order.

**Immunization in Tuberculosis.**—The disadvantages of immunization by the injection of tuberculin or emulsion of bacilli are as follows: The inoculations must be continued for a long time in order to secure a result—for many months and even a year or two. The presence of mixed infection in most tuberculous lesions is an element of uncertainty and may require a mixed bacterin, as discussed in succeeding paragraphs. In the long term of the inoculations the influence of other treatment cannot be disregarded, such as hygienic surroundings, climate, forced feeding, tonics and the like, and in the absence of such management of the disease the inoculations fail absolutely, as they also do when an active surgical focus of tuberculosis has not been properly interfered with. These facts seem to indicate that injections alone cannot be relied on and that they will make no headway against neglected or improper surgical or medical treatment and its common result in the progress of the disease. The accepted preparations are in descending order of potency: (1) emulsion of bacilli (B. E.) and (2) new tuberculin (T. R.) and the doses, as in all other immunization, aim to avoid severe reaction, much depression and prolonged negative phase. As the bacillus of tuberculosis is one of the most toxic it follows that the initial doses must be very small and the ascent in quantity very gradual. The emulsion of bacilli is much more potent than the tuberculin and the initial dose is commonly  $\frac{1}{100000}$  of a milligram administered every three to seven days and slowly increasing. The new tuberculin is given in doses of from  $\frac{1}{40000}$  to  $\frac{1}{5000}$  of a milligram and the increase between these limits is slow and judicious. It is well to give a longer rest than the common interval of dose between each change in the strength of dilution used and to insist on preserving regularity and coöperation by the patient.

**Record of Immunizing Doses.**—The importance of following immunization in accordance with the results of each dose makes it advisable



to adopt a chart or record. One which the author has found of great service follows.

In the left-hand column are given the gross doses in terms of tenths of a cubic centimeter, which is a convenient quantity for accurate measure and readily provided by the author's syringe.

In the second column are set forth the net dose in milligrams, which in the specimen record shown begins with 0.00001 and ascends to 0.00010. Such a series of doses will change with each stronger dilution employed and the same dose may be repeated several times according to indication so that the ascent through a series of ten doses from the weakest to the strongest dose of the series may be protracted for much more than one month as shown in the specimen record.

In the third column are shown the dilution of bacillus emulsion employed which will change with each such dilution selected. In ordinary experience the next strength would be 1 in 1000.

In the fourth column are contained the quadrants of the glutei employed for either the subcutaneous or the intramuscular injection as described in a contribution by the writer<sup>1</sup> on the subject of the treatment of syphilis.

In the fifth column are noted the doses actually given, each in a separate small column of its own bearing at the top the date of the visit, whose interval in the specimen record is every three days but may be made longer according to indications. By turning the chart around and writing in these date columns, as shown in the last one, brief notes of particular features may be kept.

The heading of the chart contains the name and the suggested diagnosis.

CHART FOR IMMUNIZING DOSES IN TUBERCULOUS AND GONOCOCCAL INFECTION.

Name .....				
Date of Treatment .....				
Gross dose in c.c.	Net dose in mg.	Dilution B. E. 1 in.	Quadrants of the glutei employed. <sup>1</sup>	Range of dose 0.00001 to 0.00010 mg.
0.1	.00001	10,000	Right upper 3"	0.1
0.2	.00002	10,000	Left upper 3"	0.2
0.3	.00003	10,000	Right upper 5"	0.3
0.4	.00004	10,000	Left upper 5"	0.4
0.5	.00005	10,000	Right lower 1"	0.5
0.6	.00006	10,000	Left lower 1"	0.6
0.7	.00007	10,000	Right lower 3"	0.7
0.8	.00008	10,000	Left lower 3"	0.8
0.9	.00009	10,000	Right lower 5"	0.9
1.0	.00010	10,000	Left lower 5"	1.0

In gonococcal immunization the same form of record is adopted except that the third column shows the number of organisms in each cubic centimeter and changes with the selection of stronger bacterins.

<sup>1</sup> This method of dividing the glutei into quadrants is fully described by the author, "Intramuscular Injections in the Treatment of Syphilis," New York State Med. Jour., March, 1909.

## CHAPTER X.

### GONOCOCCAL INFECTION IN THE FEMALE.

#### ANATOMY OF THE FEMALE UROGENITAL SYSTEM.

**Importance.**—Detailed anatomy cannot be given for lack of space. The reader will consult works on gross anatomy and on normal and pathological minute anatomy. In the female sexual and urinary sys-

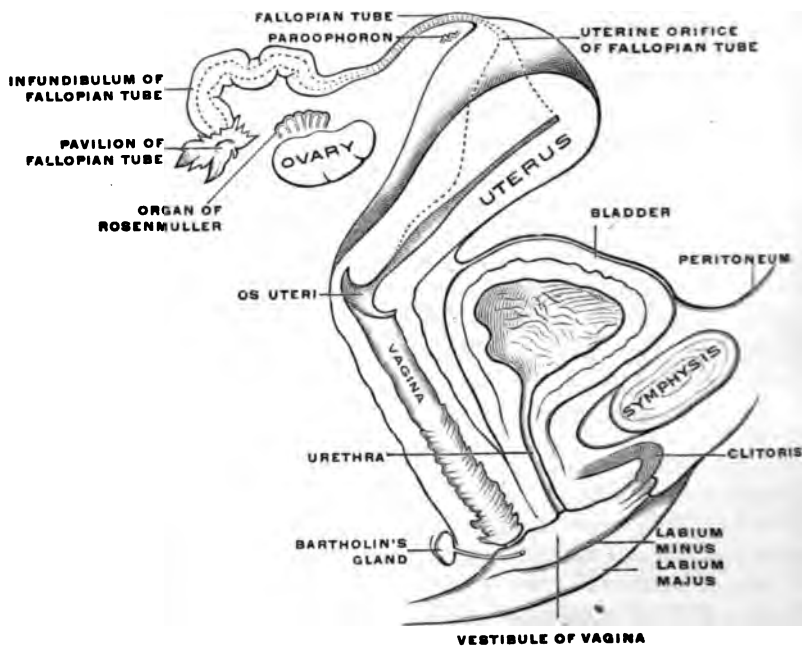


FIG. 121.—Diagram of the female reproductive organs and of their relations to the bladder and urethra in lateral view. The continuity of surface between the labia majora and minora externally and the vagina cavity of the uterus and tubes in the sexual system and the continuity of surface between the external organs and the urethra, bladder, ureters and kidneys of the urinary system are clearly shown. (Toldt.<sup>1</sup>)

tems there exists continuity in all organs of their mucous membrane linings as shown in Fig. 121. This is the principle which must be remembered in the surgery of an infection like the gonococcal.

**Gross Anatomy.**—In the urinary system the plan is the same as that in the male. In the sexual system the secretory glands are the

<sup>1</sup> An Atlas of Human Anatomy, 1904, section iv, p. 500.

ovaries, from which continuous canals begin with each tube and end primarily with the os externum uteri and with the vulva secondarily. These relations are illustrated in Fig. 121.

**Minute Anatomy.**—The universal mucous lining is closely similar from system to system and organ to organ. Function determines the epithelial and glandular details. As in all other mucosæ, those of these systems react unfavorably to infection through poor resistance and slow recovery. Chronic inflammation is very common, with temporary or permanent damage in epithelial modification in mild cases and membranous destruction in severe cases. These general facts must never be forgotten in diagnosis and treatment.

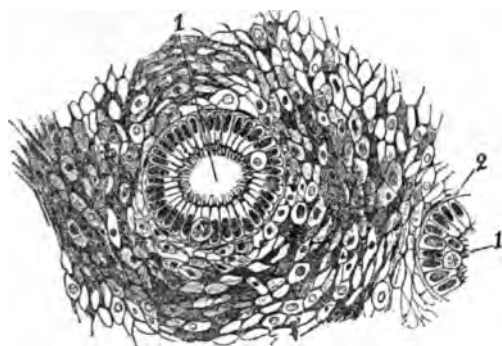


FIG. 122.—Transverse section of the mucous gland from the body of the human uterus. 1, 1, gland with central canal and ciliated cylindrical epithelium; 2, basal membrane of the wall outside in which is seen the mucous chorion. (Nagel.)

### UROGENITAL INFECTIONS IN GENERAL.

**Varieties.**—Varieties are determined by the organ infected and by the form of infection. There are therefore distinguished according to the organ attacked: (1) In the urinary system, urethritis, urethrocystitis, cystitis, ureteritis, pyelitis, as pyelonephritis, as individual or associated lesions; and (2) in the sexual system vulvitis, vestibular adenitis, vaginitis, cervicitis, endometritis, salpingitis, oöphoritis, and peritonitis sometimes as individual but more commonly as associated lesions. According to the form of infection for our purposes there are two classes, the nongonococcal and the gonococcal, of which as sexually acquired diseases the latter is by far the most common but among parturient lesions the former is similarly frequent.

Pathology is in all its features analogous to that in the male in both the gonococcal and the nongonococcal forms. The former is our type. The essence of the process is an invasion of the organism with desquamation and moderate exudation followed by penetration and free pus formation and more or less destruction. Later there is cell substitution and a change from specialized epithelium to squamous and

<sup>1</sup> Die weiblichen Geschlechtsorgane, 1896, p. 89.

from squamous epithelium to true cicatrix. The tissues are the mucosa in the primary involvement followed by the submucosa, the glands and the substance of the organ itself. Such lesions are seen in the urethra, vulva, vagina, cervical and corporeal endometrium, and oviducts in the primary process but in the secondary extensions into the urinary system, the bladder, ureters and kidneys and in the sexual system the uterus, ovaries and peritoneal cavity are invaded. The system at large may suffer through such extension in either of these regions of the body. The types of lesion are analogous of those in the male as well as the tendency to extension and penetration. The temporary lesions are seen only in mild cases and in less involved regions of severe cases and have the faculty of advance from focal points to general or disseminate forms. The permanent lesions know no precise limit as all and any varieties and correlations of lesions within the lining and the substance of the organs of both the urinary and sexual systems are seen. The annexa of the uterus furnish the best illustration as is noted by Norris:<sup>1</sup> "In the latter location the prolongation of symptoms may be traced to three definite causes: reinfection, either autoinfection from the cervix and endometrium, or from without, may occur; or secondary infection may result and the lesions be actively continued by organisms other than the gonococcus; and, lastly, the scar tissue or adhesions resulting from the active infection may persist and produce symptoms." Whereas this quotation conjoins pathology with symptomatology it is a revelation of the pathologic element. In the glands the ducts may close and true retention abscesses with the parenchyma and capsule of the gland destroyed, leaving a true pyogenic membrane and forming a typical phlegmon. Or the ducts may shut and the destruction be much less and cysts may form. Or the duct and gland may be profoundly diseased without occlusion and continue to discharge as a sinus persistently or intermittently. Any of the glands may be so affected, for example, the mucous crypts of the vulva and vagina, the more complex glands of the cervix and endometrium, Skene's glands in the urethra and the vestibular glands. All these details duplicate the process in the male in homologous regions. The associated lesions are, as in the male, depreciated tissue and visceral resistance which are locally primary processes followed by lowered general resistance often as the secondary lesion. Thus pyogenic infection from within such as the *Bacillus coli* and *Bacillus tuberculosis* or from without such as the *Bacillus tuberculosis*, *Streptococcus* and *Staphylococcus pyogenes* are directly invited and it is at least likely that neoplastic change is more readily developed in such damaged than in normal organs. Sterility and ectopic gestation are such common sequels as to be almost invariable.

The complicating lesions are properly only those which involve organs in less direct continuity with the vulvovaginal outlet. They, therefore, include the urinary system above the sphincter vesicæ and other

<sup>1</sup> Gonorrhea in Women, 1913, p. 88.

mucous membranes, such as those of the mouth and rectum, nose and eye and finally any organ of the general system. Thus the female experiences the same complications as the male. Extensions of the infection from one part of the sexual mucosa to another should be regarded as added invasions or as progress from part to part of the same field and not as complications.

**Etiology.**—Etiology recognizes the same factors as in the male in the classification of local and systemic, predisposing and exciting factors and finally bacterial causes. Sufficient discussion of all but the last will be found in the corresponding paragraphs on the male. The bacterial elements are nongonococcal and gonococcal and in the nongonococcal lesions are noted the same dyscrasias for the eruptive and diathetic forms, the same trauma by heat, cold, chemicals, violent intercourse, unnatural practices and rape. The *Micrococcus catarrhalis* causes the catarrhal lesions often grafted on a cured gonococcal infection or the damaged organs of miscarriage and childbirth. The specific organisms of syphilis and chancroid are discussed in these forms of urethritis in the male on pages 29 and 30. Almost equally important as gonococcal suppuration is pyogenic infection most commonly arising from the *Streptococcus* and the *Staphylococcus pyogenes* and the *Bacillus coli* in pure culture or association with each other or the gonococcus.

The gonococcal lesions are the most usual and in sexually acquired afflictions practically the sole cause. The gonococcus appears in pure culture or associated with the organisms just stated or with those enumerated in paragraphs dealing on this subject on page 22. Primary infections are the rule but often they are secondary to other urogenital disease, such as catarrhs after miscarriage and childbirth. The value of careful laboratory investigation as to the number, morphology and activity of the gonococcus is spoken of under this title in etiology in the male on pages 24 to 27.

**Bacteriology.**—The bacteriology of the gonococcus is the same as detailed for the male and rests somewhat on the number, morphology and virulence of the organism on the following general principles: In the incubation (late) and in the invasion (early) the exudate is mucus and serum mixed with epithelia, red blood cells, scattered pus cells and detritus. The gonococci are few and scattered or occasionally more numerous, usually extracellular, floating in the mucus and serum and occasionally supracellular and still more rarely intracellular. The distinction between the last two is by focussing and by detecting overlap or overhang of the organisms beyond the margin of the pus or epithelial cells. In the invasion (late) or in the establishment (early) the discharge is mucopurulent and the pus cells are an obvious and increasing factor and the gonococci are much more numerous with intracellular relation conspicuous, supracellular position common, and extracellular freedom decreasing or rare. In the establishment (full) pus cells predominate over all other elements, even masking red blood cells, epithelia and detritus. The gonococci are more numerous, as a rule, but in comparison with the redundancy of pus cells they may appear less numerous

than in other stages. In the termination, according to Guiteras,<sup>1</sup> the pus cells progressively decrease and degenerate, showing fat globules. The gonococci are few and hard to find and desquamation of epithelia continues. The activity of pus formation and the persistence of gonococci are closely related so that the former is an index of the latter and of infectiousness.

In the chronic or shred stage a variety of conditions appear. Pus, epithelium and detritus with extracellular and intracellular gonococci mark active shreds. Mucus, epithelia and detritus with few or no gonococci indicate more nearly cured cases. It is in this period that inversion forms of the gonococcus appear and other organisms such as the *Micrococcus catarrhalis* are in evidence prolonging the discharge. It is, therefore, in this stage perhaps more than in any other that culture of the specimen must be made by a skilled laboratory expert for final conclusions.

The clinical symptoms and course progress *pari passu* with the number and virulence of the infecting organisms in gonococcal as in other disease. Unfortunately, bacteriology on account of technical difficulties of prompt distinction between the various strains of the gonococcus cannot foretell mild from severe cases. Clinical evidence outweighs all other evidence, but the microscope on the foregoing principles is of great value when they are applied to a large number of smears taken at the same time, because the condition of one smear may be peculiar to that smear and not an index of the number of germs and pus cells and other exudate in the case *per se*.

**Pathology.**—Pathology in its general features duplicates that found in the male; but the pathological varieties differ in children and adults. In the child there are severe mucosal lesions with somewhat less organic and peritoneal change because the organs are undeveloped; but in adults all the organs may be profoundly affected and the peritoneum included in the process. Infantile uterus is assumed to be, in many cases, the outcome of infantile gonococcal disease through atrophy of the endometrium and metrium.

The primary cases are those of initial infection without any antecedent or causal condition and the secondary cases are the relapses of previous gonococcal disease or new infections of other lesions, such as the damage of childbirth. The essence and stages are those seen in the male and include: (1) inoculation, which except for the presence of the gonococcus and its colonization is without lesions; (2) incubation, which shows the growth of the organisms, the earliest degree of desquamation and a mucous serous or mucoserous exudate; (3) establishment, which is desquamation in full development, purulent or blood discharge, and infiltration of small round cells and white blood cells, and (4) termination, which is slow subsidence of the other processes, effort at repair but often with replacement of specialized epithelium with squamous cells or substitution of squamous epithelium with true

<sup>1</sup> Urology, 1912, ii, 358.

scar tissue. Chronic local catarrhal inflammation often persists as a sequel.

The tissues and organs involved are regularly the mucous membrane of any part of the urinogenital tract from which the disease by penetration may involve the substance of the organs themselves as is seen in the extension of endometritis to metritis and of cystitis to pancystitis and of pyelitis to pyelonephritis or renal abscess. The temporary lesions are such as affect the surface of the mucosa alone as in mild cases or in less involved zones of severe cases, while the permanent lesions represent penetration of the disease and destruction more or less profound and widely distributed. The associated lesions are the same process located in other organs of the same system, as the vagina and uterus in the sexual organs or as the urethra and bladder in the urinary viscera. They may also be the same lesion in adjoining organs of the two systems as the invariable occurrence of vulvovaginitis and urethritis. The complicating lesions are the disease in extragenital systems, such as the mucosa of the eye, rectum, respiratory system and, in the body at large, as in arthritis. Details of the pathology are briefly mentioned under each organ.

**Symptomatology.**—Symptoms in general characters are like those in the male. In children they are chiefly objective through the absence of descriptive power other than that of pain. In the primary cases one is dealing with initial and immediate infection and its syndrome; but in the secondary cases almost any antecedent condition may mask the onset, establishment and course of the disease. As in any other disease, the forms are hyperacute, which is rare, acute, which is the average case, subacute, which is the declining period and chronic, which marks a protracted or a incomplete termination and the periods are those of invasion, establishment and termination. In the average case the systems involved are the sexual system in part or whole and the urinary system as to the urethra in all cases and the upper tract in complicated cases, which may otherwise add any remote mucous tract or organ of the body.

The clinical features of the disease will be considered as they appear in each organ of the sexual and the urinary systems.

## I. URINARY SYSTEM.

### URETHRITIS.

**Varieties.**—Varieties, as in the male, are nongonococcal and gonococcal, of which the former is far less common and important than the latter, which is almost the uniform rule in disease sexually acquired.

**Nongonococcal Urethritis.**—Nongonococcal urethritis is much less obvious in the female than in the male on account of the short urethra and wide open vulva. The varieties are the eruptive and diathetic, which are very uncommon, while the catarrhal, traumatic, syphilitic,



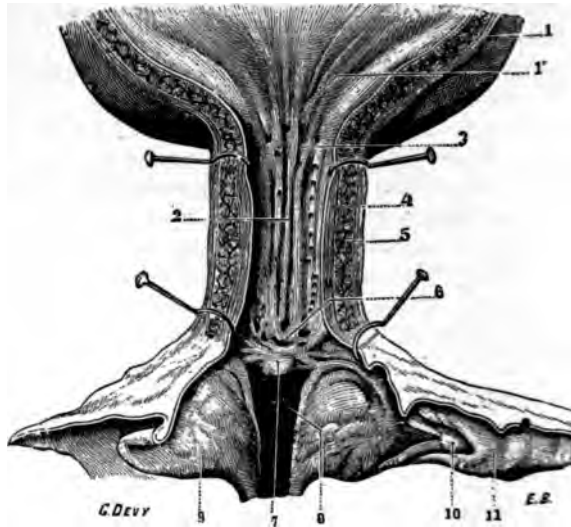


FIG. 123.—Female urethra from above. The anterior or upper wall of the urethra and bladder have been removed and the mucosa extended. 1, bladder; 1', neck of bladder; 2, urethra, with longitudinal folds and glandular outlets; 3, crest of the urethra; 4, urethral muscularis; 5, external sphincter; 6, urinary meatus; 7, vaginal tubercle; 8, labia minora; 9, clitoris; 10, prepuce of clitoris. (Testut.<sup>1</sup>)

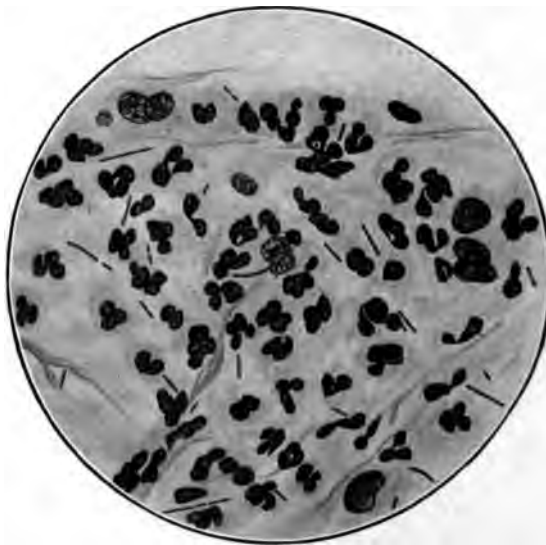
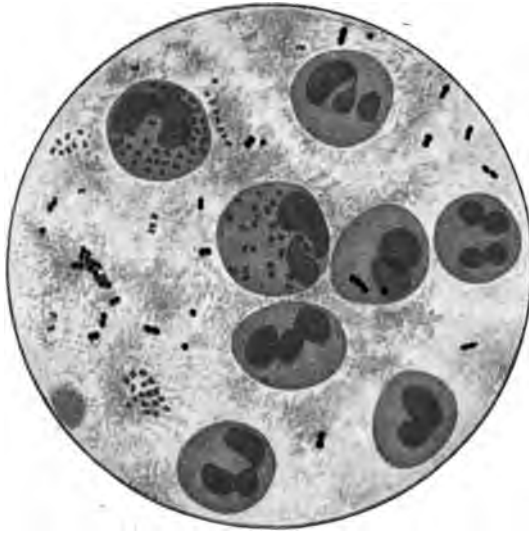


FIG. 124.—Acute venereal ulcer or chancroid of the vulva. Smear from the ulcer stained with Methylene-blue stain. (800 diameters.) In the field are shown numerous characteristic straight or slightly curved, long, rather thick bacilli with almost square ends. As a rule they occur singly but occasionally in short chains and mostly extracellular although exceptionally intracellular. (Lipschütz.<sup>2</sup>)

<sup>1</sup> *Traité d'Anatomie Humaine*, 6th ed., 1911–12, vol. 4.

<sup>2</sup> *Loc. cit.*

## PLATE X



### Gonococcal Chronic Urethritis in the Female. (Lipschütz.<sup>1</sup>)

Smear of secretion secured by expression of glands. Gram's stain (1000 diameters). In the field are several polynuclear leukocytes filled with typical gonococci in contrast stain. A few gonococci are extracellular. Short diplobacilli, stained blue-black, are contrasted with the gonococci and are seen extracellular and intracellular. During the acute of the gonococcal inflammation, through the multiplication and activities of the gonococci, the presence of the normal flora of the mucosa is masked. When, however, the chronic stages supervene the normal organisms reappear without great influence on the gonococci.

<sup>1</sup>Bacteriologischer Grundriss und Atlas der Geschlechtskrankheiten. 1913.



chancroidal and suppurative differ in no material degree from those of the male except in the factor that the urethra in woman is the homologue of the posterior portion in the male and that, therefore, irritation of the bladder is often an early symptom. The causes also do not differ in the two sexes. In clinical features these forms are more or less like very mild degrees of gonococcal invasion, which is taken as the type. Fuller details are given in the sections of this work dealing with the male. Suppurative nongonococcal urethritis may equal the gonococcal in severity, course, termination and complications and is then distinguished from it only bacteriologically.

**Gonococcal Urethritis.—Varieties.**—The varieties are acute, subacute and chronic and the etiology is regularly the gonococcus in pure or mixed culture. The gross pathology during the acute period is that of a severe suppurative inflammation of the mucosa with unmistakable desquamation, penetration and infiltration. It shows as gross lesions a meatus with redness, edema, bogginess, tenderness and thickening, followed by glandular disease as in Skene's glands and in abundant generalized highly infectious purulent exudate. During the subacute or declining state infiltration of the mucosa and less discharge are the features. These may all be temporary lesions and recovery from them complete; but in the chronic stage almost any permanent lesion may appear, such as persistent, suppurative or catarrhal inflammation, obstinate abscess or sinus and even cicatrix infiltration, dryness and glandular destruction, exactly as in the male. The microscopic lesions are congestion, hyperemia, desquamation and purulence as the temporary signs and cellular substitution, scar tissue formation, abscess and sinus as the permanent result, as further detailed in the section on the male on page 32.

**Symptoms.**—The urethra is, if not primarily, always secondarily, invaded by the gonococcus, which marks the significance of urethritis as great. The relation of the meatus to the introitus of the vagina makes infection through intercourse almost certain to reach the urethra combined with the mild trauma of coitus. The meatus urinarius consists of a folded dimple in the nonparous woman closed by two prominent labia but in the parous female this outlet gapes exactly as the vulva does. The disease may be ascending from its urethrovulvar focus or descending from the cervix and vagina. The symptoms are therefore often masked by accompanying acute or chronic vulvovaginitis and vary with acute and chronic forms and may be classified as local and systemic, subjective and objective.

The subjective local acute symptoms are sensory and functional. The invasion is marked by discomfort and tickling followed by a watery, then a mucous moisture and by slight frequency of urination. The establishment changes the sensations to positive pain and burning of urination and still greater pain when the glandules are involved and modifies the discharge to active purulence and sometimes slight hemorrhage. Rupture of glandular abscesses adds more pus. In more severe cases pollakiuria and tenesmus appear exactly as in the male.

The subjective and objective systemic acute symptoms are either absent or there are chill and fever and other signs of acute pus process.

The objective local acute symptoms are circulatory change, discharge, prominence, eversion, infiltration and glandular enlargement of the mucosa. In the invasion the hyperemia is evident and progresses and the discharge is scanty mucus or serum. Thickening of the canal is absent and glandular infection doubtful. In the establishment when the pain and frequency are great, redness, prominence, eversion and infiltration of the mucosa appear. The discharge is abundant, purulent and even hemorrhagic and easily expressed by stripping with one, or better, two fingers. Skene's glands show as reddened points, discharging droplets of pus, and other glands of the urethra are like hardened spots whose contents evacuate on pressure. The whole canal is infiltrated and edematous and the glands being most numerous along the floor lead to suburethral abscesses as described by Hey,<sup>1</sup> in 1805. The paraurethral glands, when present, may also become involved and discharge either into the urethra, upon the vestibule or into the vagina. Gonococci are abundant in the discharge in all these stages on smear and culture test and often urinalysis, but in the female the multiple glass tests of the urine cannot be applied. In the termination, the mild cases subside and go on to cure without sequels or complications, but the average and the severe cases show a slow, irregular subsidence due to glandular disease and discharge which may be accompanied more or less with urinary frequency, ardor and tenesmus as the glands relapse in their disease. Still other cases become truly chronic almost exactly as in the male.

Chronic urethritis shows few subjective symptoms but occasionally there is urinary disturbance or urethral discomfort through the lighting up of glandular infection. Objective signs are much more important, because pressure on the glands reveals shotlike masses which exude a drop of pus usually containing the gonococcus, infiltration and stricture of the mucosa, and sinuses and fistulae of minute abscesses, which have discharged into the vagina or vestibule instead of into the urethra. The tendency of the urethral mucosa to have persistent catarrhal or suppurative discharge even after the gonococcus has disappeared is as common in woman as in man.

**Diagnosis.**—The recognition of gonococcal acute urethritis in the female is usually easy and rests on the four factors emphasized throughout this work. In the history are the elements of illicit intercourse or of "weakness" soon after marriage introducing the typical syndrome of infection. Or later in wedlock the husband may be known to have been diseased. Most significant is the record of vulvovaginitis, as urethritis rarely occurs alone. The symptoms are those of moderate or severe urinary disturbance, pain, frequency, tenesmus, occasionally bleeding, together with those of the antecedent or concomitant vulvovaginitis. The physical examination verifies the presence of pus and

<sup>1</sup> Practical Observations in Surgery, Philadelphia, 1805, p. 304.

other signs of inflammation, and the laboratory findings are the most important. It is usual for acute urethritis to develop abundant pus in which the gonococcus is rare in the early invasion but very common and numerous in the establishment and again decreases in the termination unless glandules have become invaded. Evacuation of these develops a drop of pus invariably containing the gonococcus or its allies. On the other hand chronic urethritis requires careful stripping of the urethra best with two fingers in the vagina and the evacuation of Skene's glands with the hairpin method. Fistulæ and sinuses are likewise treated. The urethroscope studies and localizes such lesions in the canal and Garceau's meatoscope is of aid.

In all cases a single negative determination cannot be trusted but must be consistently supported by a series of negative reports. Smear and culture are mutually corroborative and the gonococcal complement fixation test is reserved for the complicated examples. In the treatment the value of antigenococcal measures aids in the proof. During the treatment specimens of final character are often obtained.

**Treatment.**—Urethritis in the female is very rarely indeed the sole infection. The eyes come first in prophylaxis in the ordinary cleanliness of the fingers and the proper burning of dressings. Extension from the urethra to the bladder is prevented by urinary antiseptics, such as boric acid, salol, hexamethylenamin and benzoate of soda. The vulva, vagina and cervix, if normal, are carefully protected during the local treatment of the urethra. Coitus is, of course, forbidden. Abortive treatment, as in the male, rests on immediate bacteriologic diagnosis and the applications and instillations of the same germicides. The simple character of the symptoms attracts so little attention that these measures can rarely be applied.

Enumeration of details of management is contained in Chapter IX on General Principles of Treatment on page 483.

**Curative Treatment.**—The acute period rapidly passes into the chronic and, as in the male, attacks of attenuated strains of the gonococcus may recover with little attention.

The physical measures begin with hydrotherapy and chiefly with very hot sitting baths, as detailed in the male, to decongest, soothe, and decrease the pain, frequency and irritation. Douches applied with the patient on a bed-pan and a pitcherful of hot solvents of pus are useful. Normal salt solution or sterile water is the best and these are followed by hot weak antiseptic solutions and a dressing to protect the vulva. The dressing for the discharge, as in the male, should not bottle up the exudate, which should have free outlet. Infection of the annexa of the urethra is avoided through frequent changing. As in the male, the cavity of the urethra should be left alone until the declining period is well established. This obviates unexpected increase in the severity of symptoms and the extension and penetration of the gonococci. As in the male, foreign bodies in the urethra are not advised, such as gauze

<sup>1</sup> Surg., Gynec. and Obst., January, 1912, p. 80.

or cotton and medicated bougies. Their irritation is greater than their medication and the reaction exceeds the benefit.

The medicinal treatment of the acute period follows the rule in the opposite sex. The local measures leave the urethral cavity itself alone until the severe symptoms subside, as in the male. Irrigation in the method employed in men is not easily possible on account of the short canal and the proximity of the bladder, although the Valentine-Janet method offers special nozzles for this purpose. It is better to inject small quantities of the antiseptics with a small cone-point urethral syringe or a medicine dropper, followed later by instillations. The solutions, frequency and other data are the same as in men. Above all, the patient always urinates first to wash out as much pus as possible. The best fluid of all is nitrate of silver properly graduated so as not to cause irritation or reaction. Argyrol 3 to 20 per cent. or protargol 1 to 5 per cent. and potassium permanganate 1 to 8000 to 1 to 3000 are excellent. The weaker strengths, greater frequency and injection method avail for the earlier periods, while greater concentration, longer intervals and instillations are for the subacute and chronic periods. The medicine dropper, small male urethral hand syringe and the soft-rubber catheter with Janet-Frank syringe or with the Hayden instilling syringe are all available. The retention of urine after each treatment for several hours permits penetration of the application.

The systemic medication comprises the urinary diluents, antiseptics and balsams, resins and oleoresins. The selection, combination and prescription correspond with those in the male.

In the chronic stage the progress is slow, the course long and the condition due to early faulty or overactive treatment. Prophylaxis considers the patient herself and her neighbors. Her suffering is so slight that, like men, women neglect the condition and full coöperation is difficult to obtain. Thus frequent infections in wedlock and in prostitution occur. The local measures are as follows: The amount of pus may be very little and arise in a generalized, localized or disseminate folliculitis. Infection of Skene's glands is common and usually bilateral. The best diagnostic step is to support the urethra with two fingers in the vagina, close together, with the urethra in the interval between them and steadied from rolling out of reach. A sterilized hairpin is used to express the contents of first one gland and then the other. This disease is cured by instillation, incision or excision. With a hypodermic syringe and blunted needle, nitrate of silver is instilled in strength of 2 to 10 per cent. or more, protargol 3 to 5 per cent., argyrol 10 to 20 per cent., chromic acid 2 to 10 per cent. The systemic administration continues to modify those of the acute stages seen in the male. They preserve the urine in non-irritating condition, stimulate the mucosa and maintain proper diet and habit.

The surgical measures are chiefly operative, as the non-operative measures are included under local treatment. Skene's glands and stricture are the chief fields. Skene's glands may be excised exactly



like the vulvovaginal glands, but incision is better. Skene's<sup>1</sup> technic is as follows: A probe is pressed to the bottom of the gland and a free incision is made along the floor of the urethra from the vestibule. The cavity and substance of the gland are then destroyed with the actual cautery. A similar procedure may be followed from within the urethra by retracting the meatus with the wire, the Skene-Folsom meatoscope, with hairpins bent to a right angle and grasped in artery clamps after the method of Hunner<sup>2</sup> or with an Outerbridge intrauterine pessary as preferred by Taussig.<sup>3</sup>

**Aftertreatment.**—In both sexes afflicted with gonococcal urethritis the immediate aftertreatment is continuation of good habits in diet, drink and sexual relations. The patient should be kept under close observation against reinfection and relapse. The remote aftercare is thorough and repeated bacteriologic examination in the quiescent and stimulated conditions until a negative result is consistently maintained. Only then may family life be resumed.

**Cure.**—It is essential for the patient that the cure be absolute, both pathologically and symptomatically. It is necessary for husband and community that the cure be bacteriologically perfect, in other words the social side of the matter is as important in the female as in the male. The gonococcal complement fixation test is rarely positive in urethritis. It must be made negative.

## II. SEXUAL SYSTEM.

### GONOCOCCAL VULVITIS.

**Significance.**—Significance is its common and primary occurrence through direct contact and with the penis and less common by descending infection from cervix and vagina.

**Varieties.**—The varieties are acute, subacute and chronic and the gonococcus of Neisser is the etiology in pure or mixed culture. The gross pathology modifies with the acute, declining and chronic period and follows the general character of suppurative dermatitis with such temporary lesions in the mild cases as congestion, desquamation and discharge laden with the gonococcus. The deeper inflammation produces ulceration and crusts with less general exudate and fewer organisms and the permanent lesions pass into chronic dermatitis and condylomata acuminata. Folliculitis of the hair on the skin surface is common. The associated lesions are those in the urethra, vagina, cervix and vulvovaginal glands. The minute pathology shows the common features of hyperemia, diapedesis, exfoliation, pus-formation which may be increased to ulcers, scabs and papillomata.

**Symptoms.**—Symptoms are acute and chronic, local and systemic, subjective and objective.

<sup>1</sup> *Treatise of the Diseases of Women*, 1889, p. 886.

<sup>2</sup> In Kelly and Noble, *Gynecology and Abdominal Surgery*, 1907, i, 451.

<sup>3</sup> *Jour. Missouri State Med. Assn.*, November, 1912, p. 137.

Acute vulvitis fulfils the type of dermatitis with folliculitis of the hair modified by the coexisting urethritis, vaginitis and vestibular adenitis. The circulatory signs are congestion, hyperemia, edema and infiltration; the sensory signs are discomfort and pain, and the functional disturbances are frequency of urination (more apt to be due to the urethritis) and discharge. Gonococci are usually abundant.

The subjective and objective systemic symptoms may be slight or absent but in the average case are those of septic process—chill or chilliness, fever, prostration and the like. The subjective local symptoms are sensory and functional and during the invasion are discomfort increasing to pain and a discharge which is first mucous and scanty, then with establishment copious and purulent, especially from the inner surface of the vulva.

The objective local symptoms are hyperemia, edema and irritation about the labia, fourchette, hymen or its remnants, marking the invasion. Tenderness and discharge then appear, at first scanty and mucous, then purulent and, still later, folliculitis of the skin surface. Establishment reveals edema, infiltration, free pus, crusts and ulcers, fissures and cracks. The termination offers subsidence of circulatory and then sensory disturbance, urination becomes normal, discharge decreases and in the cleanly crusts never appear or disappear under proper toilet. Neglected cases continue to have eczema, adenitis and condylomata, and many develop typically chronic relapsing lesion.

Chronic vulvitis is characterized chiefly by persistent and relapsing dermatitis and eczema with frequent follicular abscesses of the hairy surface. These conditions are not often seen in cleanly patients but are common in outpatient department subjects.

**Diagnosis.**—The elements of the acute and chronic lesions vary.

The acute vulvitis is very easily recognized from the congestion, infiltration and discharge and accompanying gonococcal infections in the urethra and other sexual organs. The gonococcus is often obtained from the folds of the vulva and the contents of glands after expression. The hair follicles will sometimes yield specimens.

Chronic vulvitis is also easily diagnosed from the relapses of dermatitis, folliculitis, crusts and fissures and the recovery of the gonococcus in other foci and lesions of the disease.

In all cases smear and culture should be made and in the severe cases, especially with other complications, the blood test is warranted. A single negative report must be rendered final by securing a consistent series of negative reports.

**Treatment.**—Examinations for lesions above the vulva are the first step in prophylaxis because their discharge is usually the source of the vulvitis. Hot, long antiseptic douches taken in bed lying down, such as potassium permanganate or bichlorid of mercury 1 in 5000, followed by a light tampon, will keep the vulva free of discharge from the vagina and uterus, as examples. The eyes demand special attention because the scratching, rubbing and dressing of the vulva due to the itching and the discharge infect the hands. There must be no inter-

course at all, or at any rate during the acute stages, and until the discharge is reduced to very little. If coitus cannot be prevented, then full precautions must be followed by both the male and the female. Care of the bed and personal clothing is important and stains should be soaked in the solvents and not coagulants of pus, followed by soaking in antiseptic solution and then by boiling and laundering. Thus mediate infection is avoided. The abortive treatment is similar to that described in this subject in the male on page 47. The best means is painting the parts several times a day with silver nitrate solution so mild as not to damage the surface and thus invite rapid extension and deep penetration. One per cent. is probably sufficient if thoroughly and frequently applied. Mild, moist antiseptic dressings are helpful.

Particular notice is given to management in Chapter IX on General Principles of Treatment on page 483.

The physical measures are chiefly hydrotherapeutic. Douches and irrigations come first. They should be taken in bed on a pan. A pitcherful of hot solution is poured on while the labia are separated and cleansing douches of normal salt solution followed by gentle mopping of the surfaces until free of visible pus; then come the medicated douches. These may contain almost any antiseptic according to personal observation, such as: bichlorid of mercury 1 in 10,000 to 5000, potassium permanganate 1 in 8000 to 2000, carbolic acid 2 to 5 in 100, antipyrin 3 to 5 in 100. The best of all is nitrate of silver in nonirritating strength, which for the normal and modified skin of the vulva would be 1 in 500 to 250, as a douche and much stronger as a light application. The newer silver salts, such as argyrol 10 to 20 per cent., and protargol 5 to 10 per cent., are of value. Excess of fluid on the parts had best be mopped dry after the douches. Attention to the vagina is part of this treatment. Hot sitting baths and body baths are not only cleanly but reduce the congestion and pain. The parts should be carefully dried after such baths to avoid eczema of the already-invaded skin.

The medicinal measures in the acute stages are primarily those of the gonococcal acute infection. By systemic administration, sedatives may be given for the itching and pain and urinary diluents and antiseptics for the ardor and irritation. Serumtherapy is of no value except as indirect benefit may arise through its influence on the disease as a whole and even this result does not come in the acute period. By local application lead and opium wash and mild astringents, such as lead-water mixed with alum, will reduce the discomfort, edema and exudate. The douches and irrigations have been described under hydrotherapy in the preceding paragraph, because their heat is almost as important as their antiseptics.

In the chronic stage the systemic treatment is that of the gonococcal infection as described for the male on page 274, and the local applications become the stronger astringents and even the mild caustics for the excoriations, erosions and ulcers. Folliculitis requires pulling the hair out and touching the pockets with tincture of iodine. Itching is

benefited by the standard antipruritics, such as carbolic salve 2 to 5 per cent., or antipyrin salve 2 to 5 per cent. Dusting powders of mild antiseptic, protective and drying powder are good. Thymoliodid, bismuth subgallate, zinc oxid and boric acid are usually and variously combined for this purpose. The moisture must not be allowed to cake the powder upon the parts. If the skin is dry, then softening and stimulating ointments are good, such as zinc oxid ointment mixed with 2, 5 or 10 per cent. of ichthyol.

The surgical measures are nonoperative and operative. In the former group belong the dressings between the labia, of cotton or gauze but not such as to check back the vaginal discharge. They must not irritate the surfaces in the acute stage and in the chronic period they likewise absorb the pus and promote cleanliness. Frequent changes and burning of the dressings are essential. Other nonoperative means are already mentioned under Gonococcal Acute Urethritis on page 533. Strictly speaking there is no operative work except the curetting of deep ulcers and the incision and cauterization of the larger follicles.

*Aftertreatment.*—Relapses due to discharges from above should be prevented in the immediate aftertreatment and full freedom of the skin from foci of infection in the follicles is the remote aftercare.

*Cure.*—In the three senses of pathologic, bacteriologic and symptomatic relief vulvitis is always cured. It rarely affects the blood test at all.

#### GONOCOCCAL VAGINITIS.

**Significance.**—As the vagina is essentially the organ of copulation it is invariably infected primarily if penetration has been complete, but secondarily if the act has been incomplete and the urethra and vulva suffer first.

**Varieties.**—The varieties are nongonococcal and gonococcal, acute and chronic, complicated and uncomplicated. The nongonococcal varieties have the same causes, course, pathology, symptoms, termination, diagnosis and treatment as the analogous infections in other parts of the urinogenital tract and closely imitate the gonococcal which, according to the rule of this work, is taken as the type.

**Pathology.**—The pathology is in a degree determined macroscopically by the age of the victim and the period of the disease. In sexual life the lining of the vagina is squamous epithelium and closely analogous to the skin and much more resistant than in the early and late periods of life, hence acute lesions are relatively much less commonly noted than subacute and chronic. In infancy and childhood the greater delicacy of the mucosa and the absence of a firm lining are invitations to great activity of infection, and in advanced age senile atrophy lowers the resistance and enhances the inflammatory activity. For these reasons the acute manifestations predominate at these ages. The period of disease is of importance in that the more active the process the more intense the pathology. The temporary lesions of the average case are hyperemia, loss of epithelia, pus, gonococci, round-cell infil-



tration, extension until the whole cavity of the vagina is involved, followed by deeper inflammation. Superficial erosions and glandular disease are both common. Small, sometimes larger ulcers with glandular involvement of extensive character and even verrucous changes are seen and the permanent lesions are the thickenings of the mucosa, the discharge, the glandular changes and cicatrices of ulcers. The microscopic features are vascular engorgement, epithelial loss, cellular infiltration, cellular substitution, pus, superficial or deep ulceration, involvement of the glandules, penetration of infection until all coats of the canal are involved with the thickenings, persistent discharge and damage or destruction of the glands. The associated lesions are due to gonococci in other parts of the urinogenital tract and the complicating lesions belong to the urinary and the extragenital group as already stated.

**Symptoms.**—The symptomatology is acute, subacute and chronic, subjective and objective, local and systemic. The chronic stage is the one most commonly seen because the acute and subacute periods are always associated with lesions of the same activity but of far greater subjective symptoms than the vaginitis, which is therefore often largely masked and attracts comparatively little attention by the patient. Children and the aged have acute symptoms and adults subacute and chronic symptoms in predominance.

Gonococcal acute vaginitis has sensory, functional and exudative manifestations in its subjective local symptoms. During the invasion of mild degree, all symptoms are progressive from those. The sensations are those of heat, pain, soreness and foreign body. They are often referred to the perineum, vulva or rectum rather than the vagina itself. Motion, active in walking, or passive in riding, increase the pain but rest quiets it. The discharge is scanty and watery, exactly like that from the urethra and rapidly becomes mucopurulent, rather thick and tenacious. The functional disorder is urinary, and comprises frequency and pain during micturition, but is more often due to the associated urethrovulvitis than to the vaginitis itself. Ulceration and intense inflammation cause vaginismus and vaginodysnia. Likewise irritation within the vagina may cause slight rectal disturbance and even painful defecation. In the establishment the pain and allied symptoms are greatly intensified and increased. The discharge is copious, purulent, of green or yellow hue, occasionally hemorrhagic and often excoriating to the vulva and thighs.

The objective local symptoms are sensory, circulatory, exudative and must be distinguished from the signs of gonococcal disease in and about the urethra and vulva and the parts must be examined systematically from one to the other. The hymen or its remnant is red, puffy and covered with pus, which is seen to come from above after the vulva and hymen have been wiped clean. The lining of the vagina is very hyperemic, hot, tender and pulsating, and the discharge is free and purulent, as described in the preceding paragraph. The crypts and glands of the vagina behave much as do

those of the urethra, some are in a state of indolent discharge and others form minute abscesses with closed ducts and others which have ruptured may be tiny, gaping pockets. Ulceration, superficial or deep, may be scattered over the surface. The cervix is regularly found to be invaded, if the vaginitis is well established, and complications may be present in the form of lymphadenitis, endometritis, salpingitis, peritonitis and systemic absorption.

The subjective and objective systemic symptoms are absent unless the case is unusually intense or has complications leading to absorption. They are then chill or chilliness, fever, anorexia, vomiting, diarrhea, malaise, prostration and those symptoms which always go with septic invasion. It is doubtful if such a picture may be drawn by the vaginitis alone as much as by the more severe associated lesions.

The termination is that the mild cases subside with no sequels, provided the cervix above has not become involved and is, therefore, not a source of constant discharge of pus into the colpos. These are, therefore, cases of true gonococcal vulvovaginitis without extension. The average case, however, is more severe, accompanied by extension into the cervix and often uterus and the acute stages are regularly followed by one or more forms of chronic vaginitis and its sequels, which may persist for many years and even defy relief in any adequate degree.

Gonococcal chronic vaginitis is the form most commonly seen, for the reason already stated. The chief subjective complaint is that of the discharge, which is slow, indolent and persistent, or variable with intermissions, relapses and exacerbations, often copious, less commonly scanty and usually foul smelling and irritating to the skin so that the woman has eczema of the external genitals and thighs. The objective signs are those of a mucosa in chronic inflammation, thickened, exfoliating, sometimes ulcerating and its glands involved as persistently discharging pockets or as abscesses newly formed or recently ruptured and appearing as sinuses or fistulae. Signs of deeper inflammation involving the wall of the vagina are sometimes present.

Granular chronic vaginitis has been described by Finger<sup>1</sup> as consisting of numerous red and thick granules variously but usually numerously distributed over the lining, giving it a rough and granular feeling and appearance and causing a rather characteristic discharge. Papillomata or condylomata are similarly seen within the cavity of the vagina and may arise from the constant irritation of cervical discharge. Bumm<sup>2</sup> is convinced that the constant chemical irritation of cervical discharge is a more active cause of chronic vaginitis than gonococci or other infecting organisms. Ulcers, cracks and fissures in and about the vagina may act exactly as anal fissure and cause vaginismus or vaginodysnia of active degree and obstinate character.

**Diagnosis.**—The elements vary with the acute and chronic forms.

Gonococcal acute vaginitis is not difficult of recognition when typical. The history of acute cases shows focal congestion, irritati

<sup>1</sup> Die Blennorrhoe d. Sexualorgane, 1901, 5th ed., p. 359.

<sup>2</sup> According to Menge: Handbuch der Geschlechtskrankheiten, Vienna, 1910.

and discharge incident upon and infecting coitus and the subjective symptoms continue these early signs of invasion to the florid degree of the establishment. During the corresponding periods objective signs must prove that the disease is in the vagina and not in the vulva as bathed with pus from above or in the cervix as discharging pus from above. The hyperemia, discharge, glandular involvement and tenderness with occasional ulcers complete the examination. There are always signs of gonococci in the urethra, vestibular glands and cervix which are corroborative evidence. Laboratory specimens must be secured from the wall of the canal and especially from the mucous crypts, sinuses or fistulæ in order to prove that the infection is from the vagina and not from the cervix above it. Schwartz's or Schultze's method<sup>1</sup> consists in thorough cleansing of the vagina and vulva followed by careful packing of the fornices and about the cervix so that discharge from the latter cannot for many hours contaminate the vagina. Such a technic is reasonably certain to eliminate discharge from above and to isolate that from the colpos for the necessary specimens. In all cases smears and culture must be made and expert opinion consulted. The gonococcal complement fixation test is in severe and extensive cases worth while and will prove the nature of the infection as a whole but not as of any particular portion of the urinogenital tract. The diagnosis of colpitis must delimit extent and determine severity, as far as possible. As a rule, the whole vagina is infected but some portions more severely than others. The posterior cul-de-sac is a very active focus whenever the cervix is also involved. Whether or not the vaginitis is primary or secondary is another diagnostic essential, so that urethra, vulva and cervix must all come under the diagnostic study. Treatment is of value in the diagnosis only as it eliminates the other sources of gonococcal pus, leaving behind various foci in the vagina whose typical character at once becomes apparent and easy of proof.

In gonococcal chronic vaginitis all the thickenings of the mucosa, in zones variously distributed, the glandular indurations when the ducts were not occluded and the glandular sinuses and fistulæ when the ducts were occluded and abscesses formed and ruptured are the pathognomonic signs.

**Differential Diagnosis** must distinguish gonococcal vaginitis from that due to traumatism, chemical irritation, simple infections and irritating discharges from ulcers and neoplasms, by the following clinical data:

*Traumatic differs from gonococcal vaginitis* in having the history of instrumentation, tamponade, packing and pessaries all more or less properly done or used. Hot or rough instruments forcibly inserted, sponges and packing uncomfortably placed or retained until sodden in decomposing mucus and pessaries improperly fitted or placed

<sup>1</sup>Quoted without a reference by Norris, *Gonorrhea in Women*, 1913, p. 218. No such method of Schultze" seems to exist in literature, but E. Schwartz, *Die gonorrhöische Entzündung beim Weibe*, Samml. klin. Vort., 1886, No. 279, Gynäkologie No. 54-76, describes much the same method.



are all factors of a vaginitis which is usually mild, brief and without pathogenic organisms of any kind. The subjective and objective signs are those of a catarrhal lesion and the laboratory test is bereft of any important elements. Withdrawal of the cause, simple cleansing and mild stimulating treatment by their prompt cure prove the case.

*Chemical differs from gonococcal vaginitis* in its history of strong douche or applications, followed almost instantly by the inflammation and in the absence of infecting intercourse. It is essentially a traumatic vaginitis in that superficial destruction of the mucosa is an injury and its features duplicate the character but augment the degree of traumatic vaginitis just described.

*Infectious differs from gonococcal vaginitis* in its history of unclean habits and the presence of fecal and urinary deposits around the vulva and vagina or in the history of diphtheria providing the Klebs-Loeffler bacillus, or of dysentery giving the Bacillus coli or of abscesses about the rectum and uterus ruptured into the vagina discharging the pyogenic organisms, such as the streptococcus and staphylococcus. Fistulæ between the vagina and the bladder or rectum or both belong to this category. The subjective and objective symptoms are usually characteristic and traceable to the underlying cause and the laboratory will readily isolate the organisms other than the gonococcus. A negative complement fixation test in complicated cases is valuable. The caution in these cases is that they are sometimes engrafted on cured gonococcal lesions rendering the distinction not only difficult but sometimes impossible.

*Ulcerative and neoplastic differ from gonococcal vaginitis* in the history often of indefinite lancinating pains with hemorrhagic staining followed by the vaginitis, so that the whole picture is one of an antecedent with positive symptoms, such as cancerous or other ulcer of the cervix or the ulcers seen in the third degree of prolapse. Typical subjective symptoms and objective symptoms are easy of demonstration and sections of tissue for the laboratory and specimens of the discharge in smear and culture and the gonococcal complement fixation test are positive for the neoplastic origin and negative for the gonococcus. Anemia may be a prominent and early symptom of active cancer.

**Treatment.**—The general scheme of measures is the same in both primary and secondary cases, which must be distinguished as noted under diagnosis; but the antecedent foci in the urethra, vulva and cervix must have attention. In fact, probably all four regions are diseased as part of the one process in almost all cases.

The prophylaxis procures caution for the eyes and care as to the urethra, vulva and cervix as the starting-points of a vaginitis in order to prevent onset of the latter. Conversely, care of a primary vaginitis prevents involvement of any one or all of the other three zones. Indeed the diagnosis of the fact, progress and cure of a gonococcal colpitis bear on the prevention of gonococcal infection through family ties toward children and husband and social ties toward innocent or guilty victims.

The abortive measures, as in man, rest on early bacteriologic diagnosis, which is difficult because many primary cases show few symptoms and most secondary cases are marked by the forerunning foci. The best single abortive measure is to put the woman under a general anesthetic and then to paint with 10 per cent. silver nitrate solution or tincture of iodine the entire surface of the cervix, vagina and vulva while the mucosa is stretched free of folds as far as may be. The cervix is treated last and with fresh swabs. The entire region should be a definite white and ten minutes should be given for full penetration. Free solution had best not stand in any of the pockets. The posterior cul-de-sac should receive most attention. Morphine must be given to stop the pain during the first day, and the urine must be kept neutral and the bowels soft, which with rest in bed decreases irritation. Mild antiseptic douches are begun as soon as possible. One such treatment is usually sufficient. Another good abortive treatment is to give antiseptic douches every two to four hours during the waking part of the day and whenever not asleep at night. Potassium permanganate is the most easily procurable and efficient. Reaction and further extension of the disease will follow douches which are too strong, hence heat, frequency, duration and proper graduation are the secrets of success. The first solution should be 1 in 10,000, gradually increased to 1 in 2000 according to result. Such douches should be continued for at least a week and at longer intervals, two or three daily, after the gonococci seem to have disappeared. Another less serviceable method is to pass a Ferguson speculum and to fill it with 5 to 25 per cent. argyrol solution and by slowly withdrawing it permit the antiseptic to bathe all parts of the vagina. The passage of the speculum is the disadvantage of this treatment, which is best reserved as the office associate of the douches at home during the declining stages. The technic of taking a douche is described under medicinal measures. The vulva must be separately cleansed after each douche as a prophylactic step.

All the procedures of management are embraced in Chapter IX on General Principles of Treatment on page 483.

*Curative Treatment.*—The details vary with the acute, subacute or chronic period present and with attention to the other lesions in the vulva, urethra and cervix.

The physical measures are solely hydrotherapy in the form of hot and medicated douches and sitting and body baths. The local measures are the douches which are given every two, three or four hours whenever awake and best consist in a cleansing douche to remove the pus, followed by an antiseptic douche to penetrate to the diseased foci. The cleansing douches apply to the early stages when any chemical might cause increase of the disease and when reaction to any local treatment must be cautiously determined. The best are normal salt solution, sterile water, boric acid 2 to 4 per cent. and bicarbonate of soda 2 to 4 per cent.

The douche continues until the return in a glass is free of fluid pus

and contains only a few shreds. Later in the early declining stage antiseptic douches may be begun with very weak concentrations, slowly augmenting and never exciting a reaction or an increase in the symptoms or discharge. Among the very best is potassium permanganate 1 in 10,000, advancing from 1 in 2000. Norris<sup>1</sup> states that the "A. B. C." powder is an excellent medicament in douches for any form of gonococcal disease:

R—Acidi borici . . . . . 6 ounces (186 grammes)  
 Phenolis,  
 Pulveris aluminii exsiccati . . . . . 33 1 ounce ( 31 grammes)  
 Olei gaultheriæ . . . . . 1 dram ( 4 grammes)  
 Olei menthæ piperitæ . . . . . 30 minims ( 2 grammes)  
 Mix, make a powder and mark:  
 One tablespoonful in 1 gallon of hot water as a douche.

The nitrate of silver is one of the best drugs and the first solution should be 1 in 20,000, gradually increasing to 1 in 500. The newer silver salts, of which argyrol and protagol are examples, are too expensive for gallon douches and are therefore reserved for office instillations and applications. Findley<sup>2</sup> relies on formalin solution 1 in 2000.

In the chronic indolent stages the stronger solutions and astringents become available. The best are mixtures of alum and sulphate of zinc in from  $\frac{1}{2}$  to 2 per cent. strength similar to or exactly like the Ultzmann fluid used for injections and instillations in the male.

The technic of douching determines its success and must cover the instruments and supplies, the fluid, the preparation of the patient and the aftercare. The instruments and supplies are a four-quart rubber douche-bag, with six feet of rubber tube and a cutoff, suitably curved and straight glass return flow douche nozzles, a douche-pan, towels and gauze. Small bags give insufficient quantity which should be at least one gallon. The pressure should balloon the folds of the vagina which less than six feet of tube does not permit. The nozzles are best of glass for cleanliness, should have only side openings and never an end opening and the pan should permit the patient to lie upon it. The towels protect the pan, the bed and the person from being soiled and the gauze is wrapped loosely about the nozzle just at the vulva to receive the spatter and divert it into the pan as a gentle stream or dripping. Such details make the douche convenient and inviting and their omission inconvenient and annoying. The fluid should always be mixed hot in a pitcher. The temperature should be 115° F. with a bath thermometer which will deliver 110° to 105° F. Powders and concentrated solutions should never be dumped into the douche-bag, in which they often gravitate to the bottom and reach the canal in highly irritating form. From such a pitcherful of the solution the bag is filled and suspended from a convenient hook. The patient prepares herself by mopping the vulva as clean as possible, after having removed her underclothing. She lies on the bed and on the douche-pan and

<sup>1</sup> Loc. cit., p. 219.

<sup>2</sup> Diseases of Women, 1913, p. 410.

When the nozzle is inserted to the top of the vagina without pain and the gauze wrapped loosely around it in front of the vulva. When the stopcock is open the flow begins and continues until the bag is empty. After this the nozzle is removed from the vagina and disconnected from the tube and laid on a suitable piece of paper or towel. The douche-pan is taken from the bed after the patient has suitably dried with the towels. When possible the aftercare consists in keeping the patient in bed with little movement for a half-hour so that the medicine may penetrate. After this she may move about if ambulant, wearing a suitable pad to prevent staining the clothes. Douches taken in the bath-tub or sitting over the toilet lose most of their value. Douches which consist of one or two quarts of fluid are almost useless and in general it is best to give a cleansing douche of one gallon followed by an antiseptic douche of another gallon, whose temperature is almost as important as the drug.

Sitting baths in the method prescribed for males on page 57 are of great value in decongesting the entire pelvic area and organs and body baths are not to be forgotten in the general hygiene of each case. Of course the face must not be bathed during them lest the eyes be contaminated and scrubbing of the tub must never be omitted in protection of those who follow the patient.

The sterilization of instruments and supplies is important. Gauze and pads should be dropped into paper bags and burned. Douche nozzles should be boiled and stored in 1 in 5000 bichloride of mercury solution, along with about 12 inches of tubing kept as a connector attached to the nozzle and then joined to the tubing of the bag with a brass link. The pan and the double-bag should be thoroughly scalded and scrubbed.

The medicinal measures in the acute stages comprise only the cleansing and solvent douches and in the declining and chronic stages add the antiseptic douches already noted under hydrotherapy, because the heat and the volume are important. In the chronic stage direct applications to foci become important and the spray will reach recesses and folds avoided by the swab. Graduations of nitrate of silver come first from 1 to 1000 to 100, tincture of iodine 1 in 250 of 95 per cent. alcohol, and equal parts of alcohol and water are all good. The solutions recommended on page 66 for hand injections, irrigations and instillations in the male may be atomized. Polak<sup>1</sup> uses equal parts of picric acid and glycerin applied on a gauze tampon for twenty-four hours after thoroughly cleansing the vagina with a douche, inserting the Ferguson speculum and pouring one or two ounces of argyrol solution into the vagina. Daily treatments for three or five times have given this author wonderful results. Through the Ferguson speculum the writer has had good results by filling its proximal end with argyrol 10 to 50 per cent., protargol 5 to 10 per cent. and silver nitrate 1 to 5 per cent. and then slowly withdrawing the instrument, permitting the fluid to reach, bathe and penetrate all portions of the wall made tense across the opening in the instrument.

<sup>1</sup> Personal communication to the author.

The vagina must first be thoroughly douched and the withdrawal of the speculum must take at least fifteen minutes, which the patient herself or the office nurse may observe.

The ulcerations, abrasions and infiltrations of the chronic stage must be touched with caustic for superficial but not penetrating destruction. In fact, only active stimulation is desired. The author prefers watery solutions of nitrate of silver or of acid nitrate of mercury from 10 to 50 per cent. strength. Copper sulphate and zinc chloride are good in 5 per cent. to 20 per cent. strengths. Applications are made every two to five days and only after the result of one application has spent itself. Undermined edges and exuberant spots have special attention according to reaction and healing. The tender epithelial sprouts must not be destroyed at subsequent applications. The actual or the electrocautery or the high-frequency current of Oudin in the desiccating or coagulating strength as described in the soap test under electrotherapeutics in the male on page 501, may all be lightly employed.

The medicated tampon, after douching, is inserted and retained over night or for twenty-four hours. Argyrol 25 to 50 per cent., protargol 5 to 10 per cent., nitrate of silver 2 to 5 per cent., ichthyol and glycerin 10 to 25 per cent., picric acid and glycerin 10 to 25 per cent., may all be tried. Ointments and bougies are of less service. The ointments coat the surface with grease, which tends to retard the exudate and to prevent access of the drugs to the lesions.

Powders, insufflated or applied on a tampon, are of benefit in the condition of relaxed mucosa and thick discharge. They must be antiseptic, healing and astringent, such as equal parts of calomel, bismuth and boric acid or equal parts of thymol iodid, bismuth and boric acid. The powder is dusted into and heaped on a cotton tampon which is inserted every other day and retained over night, always after the cleansing and the antiseptic douches. Systemic measures are symptomatic and based on general principles and common sense.

The surgical measures recognize no operative procedures except the mild application of the actual cautery as already noted and the occasional curetting of an indolent ulcer under a local anesthetic. The nonoperative steps are the dressings, such as tampons and vulvar pads and applications as already described.

*Aftertreatment.*—Careful observation by the urologist and report by the patient of even moderate leucorrhea are the immediate after-treatment. Its appearance demands renewed attention in physical and bacteriologic examination and repeated treatment and resumption of all personal and social prophylaxis. After medication has ceased through negative bacteriologic tests the mucosa is benefited by normal salt solution douches, which are the remote aftercare until the catarrhal tendency is gone.

*Cure.*—The vaginal mucosa is rarely deeply damaged because so resistant and therefore a pathological cure is usually obtained. Freedom from discharge originating in cervix, vagina, urethra and

and from other subjective symptoms is the symptomatic cure. The most important of all is the bacteriologic question. The woman is negative after repeated examinations in both quiescent and excited stages for the gonococcus. All prophylaxis rests on this result. The gonococcal complement fixation test is usually negative, but should be negative in a cure.

### GONOCOCCAL CERVICITIS.

**Significance.**—Significance is special on the point that direct contact of the penis by the cervix and immediate entrance of the semen or into the os make gonococcal cervicitis frequently primary but usually secondary by ascent of the infection from the external os and vagina. The diseased cervix may become by direct injury of the mucosa the source of uterine lesions but fortunately its tendency is largely controlled and abated by such natural factors as constriction at the internal os, the plug of mucus, the gravitation of the secretions downward and outward against the direction of the organisms and the positive alkalinity of the secretions, which hinders or checks the growth of the gonococcus which is, on the other hand, favored by slightly acid media. Complexity and delicacy of the mucosa render penetration and persistence of the infection very difficult.

**Varieties.**—The varieties are as just stated: as to onset, primary and secondary; as to location, cervical, concerning the vaginal portion and os, and endocervical related to the mucous lining; as to course, acute, subacute and chronic, complicated and uncomplicated. The pavement epithelium of the portio vaginalis renders cervicitis rare, whereas the columnar cells of the lining invite invasion.

**Pathology.**—The pathology is subdivided into the varieties of acute and chronic with much tendency toward the latter in comparative absence of the former and the essence is exudation, hyperplasia and metaplasia of the surface of the cervix or its cavity. The typical lesions of gonococcal attack occur, such as hyperemia, exfoliation and substitution of epithelia, infiltration and glandular invasion. Temporary lesions are a rough, granular mucosa, macroscopically, and by increase of the columnar epithelia of the cavity over the squamous cells of the portio vaginalis the outer surface shows a marked granulation and the os appears to be eroded. The glandules are seen to exude a drop of pus or to have developed cysts. Slight erosions of surface are also rarely seen. The microscopic lesions are vascular engorgement, multiplication, infiltration and destruction of epithelia, erosions, invasion of glands which are either simple or compound racemose types, and gonococci in the glands as well as in the surrounding places and elsewhere in or on the mucous surface. The lesions may go on to resolution or become chronic and have as permanent lesions erosions due to the multiplication and spread of the bacteria along the surface of the mucosa and less commonly within the

glands. A tendency to cellular substitution is seen so that the mucus displaces the columnar epithelium and a reduplication of the cells is evident, least commonly within the glands but commonly over the surface. The glandular changes and periglandular deposits are often marked so that the glands are little pockets or sinuses or fistulæ in a bed of dense tissue. The associated lesions are other proofs of gonococcal disease in the vulvovaginal glands, metrium, oviducts, peritoneum and urethra; while the complications may be of the extragenital type in the system at large or urinary type above the urethra in the bladder, ureters and kidneys.

**Symptoms.**—The symptoms are acute, subacute and chronic, subjective and objective, local and systemic and the invasion progresses to establishment by development of symptoms. Gonococcal acute cervicitis or endocervicitis has sensory, functional



FIG. 125.—Arbor vitæ appearance of cervical mucosa. Magnified. This illustrates the gross anatomical reasons why, when gonococci penetrate the mucosa of the cervix, they are very difficult to eradicate. (Dudley.<sup>1</sup>)

exudative factors marking the subjective local symptoms. The signs are rare in the average case, absent in the mild attacks but present in intense invasions, perhaps chiefly due to associated conditions as Brettauer<sup>2</sup> notes in the lymphatics of the inguinal and iliac regions, whose tenderness is the chief source of pain and proof that gonococcal invasion rather than the cervix itself is a source of pain. The functional disorders are menstrual disturbances, such as irregularity in the profusion of flow from the congestion and sometimes pain from congestion and obstruction of the edematous mucosa.

The objective local symptoms are exudative, sensory, circulatory and trophic. The discharge consists of epithelia, white blood corpuscles and detritus all containing gonococci and often mixed with

<sup>1</sup> Principles and Practice of Gynecology, Lea & Febiger, Philadelphia, 1911.

<sup>2</sup> Amer. Jour. Obst., September, 1911, p. 457.



strings especially in the less acute invasions and in the chronic course. The sensory elements are tenderness to the touch of the speculum or the finger, particularly in the invasion and if there are erosions in the chronic stage. The circulatory signs are hyperemia, swelling and edema, forming a zone of redness about the os which spreads into the purplish surface of the cervix which is often peppered with red spots which institute the trophic conditions characterized by the heaping up of the columnar epithelium within the canal so that it protrudes at the os, making a red dimple. It might be called the "bull's-eye cervix" because the red spot is the center of the target surrounded by a zone of less redness, then by one of peppery red spots and finally by the livid blue of the portio vaginalis. Loss of substance as superficial or deep ulcers is seen rather uncommonly and prominence of the glands as minute abscesses is often a definite feature and leads to the cysts of the chronic period. The foregoing picture is drawn by the average nulliparous case while the multiparous woman with lacerations and changes in the cervix adds these to all that has been described. The lining of the cervix is often prominently and extensively everted and many of the changes just described have already occurred through the influence of mechanical contact between the relatively rough vaginal surface which is practically modified skin and the definitely delicate columnar epithelium of the cervix and through the chemical action of the acid vaginal secretion thereon. When the gonococcal infection of such a surface occurs its results are apt to be much more profound.

The subjective and objective systemic symptoms are very rare and when they occur rest more on the associated and complicating conditions than on the disease itself within the cervix. Such lesions have been specified under pathology and cause the symptoms always seen in infections: chill or chilliness, fever, anorexia, nausea or vomiting, diarrhea or constipation, perspiration and malaise or prostration—all variously associated and related.

The termination in very mild cases is a cure, almost spontaneously developed; but the average case is much more severe and may either pass through a catarrhal period with erosions and glandular disease and long-continued exudate before resolution occurs or may pass into the chronic state with deep changes everywhere in the mucosa and unvarying symptoms.

Gonococcal chronic cervicitis or endocervicitis follows two types, the one having persistent and rather stationary symptoms and the other having exacerbations and relapses of subacute and even acute attacks. The subjective local symptoms are sensory, functional and exudate. The sensory manifestations are pain and tenderness, usually absent but mild and indefinite when present. The functional distress is disordered menstruation, irregular in time, altered in amount, inclined to excess from the congestion and exfoliation of the mucosa already present. Such results are less manifest in endocervicitis than in endometritis. Dyspareunia is not marked but may occur from the erosions of the cervix and from cysts of the glands upon it; but sterility due to

epithelial alterations and occlusion of the canal is more common. The exudative symptoms are discharge, commonly called leucorrhœa, which is thick, stringy or flocculent, whitish or faintly yellow, containing epithelia, detritus, pus and gonococci. Frequent examinations may be negative for the organisms which may be found under stimulation by massage of the cervix, by very gentle curettement with a sterilized hairpin in the bite of an artery clamp, by chemical applications just after their acute reaction and after puncturing cysts or abscesses.

Relapses of chronic cervicitis to subacute or acute attacks are evidenced by increased discharge, active menstrual disorder and sometimes pain. They usually appear during the disturbance of menstruation, pregnancy, puerperium, medicinal applications and instrumental dilatation; in other words, during any disturbance of the parts—functional and active or therapeutic and passive. The objective local symptoms are circulatory, exudative, functional, sensory and trophic. The circulatory disorder is hyperemia and edema, both less than in acute and indolent rather than active. The exudate is usually less in quantity than in the acute form but always much thicker and stringy, flocculent and very abundant in detritus and desquamated epithelium. The gonococcus is frequent, especially after the stimuli which provoke the relapse or the application of the various stimuli already described, both functional and therapeutic. The functional activity is exemplified by the glandular discharge and the formation of cysts. The normal secretion of thin, clear and clean mucus is changed to thick, turbid and infected mucopus or even pus. The trophic changes are along the line of hypertrophy of the mucosa, by multiplication of the columnar cells and by reduplication of their layers so that the complexity of the arbor vitæ of the cervix is increased and the thickened mucosa protrudes at the os forming the so-called erosion and giving a marked granular appearance, in contrast with the normal glossy hue of the squamous epithelia on the portio vaginalis. The consistency of the cervix is soft from chronic congestion and these granulations are boggy so that bleeding is easily produced. The sensory signs are pain and tenderness of little moment but the erosions may bleed on contact and the cysts and sinuses of the glands may be tender.

The subjective and objective systemic symptoms of chronic endocervicitis are always lacking in the typical and average case but may be present in severe and complicated cases. The persistent discharge is a grave annoyance and may be a drain on the system, but to ascribe to it alone all the various functional and nervous disorders which women having these chronic lesions suffer is a misapplication of objective data because the associated lesions of the uterus, annexa and peritoneum are vastly more potent in the production of such conditions.

The termination may be a persistence of low-grade inflammation throughout life with little or no change except such as occur in the epithelia having a neoplastic tendency or the inflammation may fire up from time to time in active relapses or the glandular destruction may be prolific of cysts and sinuses. Occasionally the inflammation



itself subsides, leaving behind it numerous changes in the mucosa more or less analogous with the same process in the prostatic urethra.

**Diagnosis.**—Diagnosis of both acute and chronic cervicitis and endocervicitis is comparatively facile because the acute period may be practically absent and merge into the chronic disease. In the history coitus may usually be proved with the story of immediate discharge and indefinite abdominal sensations or of an early discharge at the vulva and then the vagina with obvious ascent and cervical symptoms after two or three weeks. Sometimes infection of lover or husband is admitted. The subjective symptoms are the doubtful pain and tenderness in the cervix, and the persistent and increasing discharge and the objective signs recognize the two forms of those without erosions and those with erosions and eversions of the mucosa, and are obtained through the speculum after cleansing of the vagina. The true "bull's-eye cervix" of the nullipara with the drop or stream of pus exuding from it in the acute infections, but the granulations, cysts and small sinuses and general edema in the chronic cases. Search for concomitant lesions of gonococcal disease must be made in the externalia. In the multipara after lacerations the erosions become prominent and deep and the engrafted gonococcal disease augments both conditions, so that the mucosa appears rough, granular, soft and hemorrhagic in the way already described.

Laboratory specimens in acute cases are redundant in the gonococcus but in the chronic cases must often be repeated before a successful result appears. Respect for the influence of physiologic hyperemia just before or after menstruation and for that of massage and caustic applications must be had before a negative conclusion is reached. The gonococcal blood test will usually be positive in marked and complicated old cases. The treatment is an aid in diagnosis through noting the value of antiseptic douches and applications.

**Differential Diagnosis.**—The differential diagnosis chiefly concerns syphilis in the chancreous or secondary stage, neoplasm and tuberculosis.

*Syphilitic differs from gonococcal cervicitis* in its history of intercourse followed by symptoms about three weeks later for chancreous cases, or about nine or ten weeks after the intercourse or six or seven weeks after the first symptoms, in secondary outbreaks, during other manifestations of this period, in any other mucosa and the skin. The subjective symptoms are pain and tenderness due to the erosion of chancre or the mucous patches which commonly bleed easily. The discharge is different in quality, being usually scanty and mucoserous or seropurulent rather than purulent. Other primary or secondary lesions may be complained of, about the vulva, mouth or anus. The objective signs prove the presence of corroborating secondary lesions and that of the chancre or patch on the surface, which is rather easy unless implanted on deep lacerations and erosions after childbirth. In any case gentle curetting of the lesions will produce the characteristic of serosanguineous discharge containing the *Treponema pallidum* or it will be found in sections cut from the os for the laboratory demonstra-

tion, which adds also the positive Wassermann test. Treatment is of great value in the diagnosis because mercurial douches and tampons locally and the newer arsenical products, such as salvarsan and neosalvarsan and the standard mercury and iodide treatment systemically, are so magical in their results as to prove the case.

*Neoplastic differs from gonococcal cervicitis* in not having a venereal element in the history unless the neoplasm is grafted on a chronic gonococcal cervicitis, which then makes the distinction unnecessary but the recognition of the cancer as important; in the subjective symptoms in being less acute and less congestive but more painful with apparently unknown cause and later much more hyperemic and hemorrhagic; in its spontaneous bleeding as an important factor and usually denoting the ulcerative stage; in its objective findings of a hard, infiltrated and firm cervix even early in the disease followed later by deep ulcerations and extension into the lateral aspect of the cervix and vagina; in its incorporation of the vagina, bladder and rectum in varying and progressing degree as the cervix becomes fixed; in its lymphatic involvement, which may be felt sometimes early and always late through the vagina and rectum and in advanced cases in the iliac and sacral regions; in its systemic symptoms of emaciation and anemia and in its progressing course and final destruction of the patient. Sections of tissue taken from the cervix will prove the cancerous nature and activity of the lesion and will distinguish it from the deposits of long-standing simple or suppurative inflammation, and syphilitic or tuberculous deposits.

*Tuberculous differs from gonococcal cervicitis* in being very rare and sometimes in the immediate or remote history of tuberculosis elsewhere in the body or in the family of the patient; in the subjective complaints of pain and bleeding and in the objective findings of tubercles, bleeding, and bacilli in the pus and in fragments of tissue taken for the laboratory which are likewise characteristic of tuberculous activity; in its picture, in advanced cases, of tuberculous anemia and emaciation and in its frequent later deposits of the disease elsewhere in the urinogenital system or the body at large. The tuberculin reaction is always positive but is so commonly positive in dwellers in cities as not to possess great value unless corroborated by the other clinical evidence. Specimens cut from the cervix and sectioned distinguish it as tuberculosis from cancer and syphilis.

**Treatment.**—As in every gonococcal infection the hands of the patients and all utensils must be scrupulously clean in the prophylaxis of the patient's eyes and of children and others with whom she must have contact. Intercourse must be forbidden in the interests of the husband or other men. The abortive measures are rarely possible because in the strict sense cervicitis is almost invariably secondary to vaginitis. Very early diagnosis may reach the first days of the infection and make the method of Polak described by Norris<sup>1</sup> practically abortive. With

<sup>1</sup> Loc. cit., p. 226. Polak, in a personal communication to the author, states that his method was described by Geis, Int. Jour. Surg., July, 1911.



the patient in the high lithotomy posture, after douching and drying the vagina a Ferguson speculum is inserted and partially filled with a 25 per cent. argyrol solution as a bath for the cervix for ten minutes. A tampon soaked in equal parts of picric acid and glycerin and supported by another lambs' wool tampon is left in the vagina for twenty-four hours. Daily repetition of this treatment is made for about a week and will check many cases of superficial gonococcal cervicitis without involvement of the canal. True endocervicitis is not benefited by this measure.

The details of management are fully described in Chapter IX on General Principles of Treatment on page 483.

*Curative Treatment.*—All technic is modified by the acute and chronic period of the disease. Most cases belong to the latter category, and permit the more radical methods while only expectant treatment may be employed in the acute stages. Primary cases are, as stated, rarely seen and almost all appear after the vagina has become involved.

The physical measures are naturally best in the chronic period and embrace massage and hydrotherapy. Massage will drain the crypts of an indolent mucosa and is a good preliminary of mopping the thick mucus away before applications. It is somewhat analogous to the massage of the male urethra upon a straight sound to evacuate the follicles.

The hydrotherapy is local and general. The former method must not be used just before, during, or after the period, and not while a tampon or packing is in the vagina. Douches are given morning, noon and night in the average case with one added in the severer infections. They must be hot within tolerance, copious to at least one gallon and chemically mild within reaction or disturbance. These details are described in the technic of douching in vaginitis on page 544. The general hydrotherapy is hot sitting baths to draw the blood from the deep pelvis and body baths for cleanliness and similar stimulation.

The medicinal measures are systemic and local and are of greatest service during the chronic rather than the acute period. The systemic administration is for the subsidence of any absorption and chiefly of the associated lesions, notably those of the urethra, vulva and vagina. In the chronic stage the influence is indirect and is aimed through tonics to build up resistance and to restore depreciated health. Serumtherapy may be tried with little promise of result. As in the male, the serum may be used in the later acute stage and the bacterin in the chronic period. The details are described under serumtherapy on page 512.

The local medication is best omitted during the ascending and descending congestion, usual three days before and after the menses. A preliminary essential is removal of the slimy slug of mucus usually adherent in the os externum. Most of the available drugs coagulate its mucopus or mucus forming a very thick soft scab protecting the diseased epithelium. An alkaline douche should be taken at home of either sodium bicarbonate, sodium biborate or normal salt solution, alone or combined to soften the mucus. In the office a speculum and

tenaculum expose the cervix which is sponged or sprayed with similar solutions and swabbed free of mucus with sterile cotton on probes. This is superficial external and internal cleansing of the cervix as far as the os internum, which must not be passed. Injections are dangerous but instillations of a few drops of mild antiseptics and caustics are of value through a syringe similar to the Bangs or Keyes instruments, with freedom for return flow so that nothing will be carried into the endometrium. Swabbing the cervix with applicators is perhaps the best method. The cotton should be almost dripping so that excess fluid will soak into the folds and crypts.

The technic of swabbing is as important as that of douching and covers the following details: After the vagina is cleansed with a solvent douche a speculum and tenaculum have exposed the cervix. Dilatation, if necessary, is secured with the Hanks' sounds passed only through the external os. All surfaces are then dried, the posterior cul-de-sac protected with gauze, the mucus plug thoroughly removed and then the swabs just dripping with the drug are inserted and moved in all directions except through the internal os in order to reach all points of the disease. The usual relative strengths and combinations of standard drugs are preferred. The best are nitrate of silver 5 to 15 per cent., tincture of iodine, pure or half-strength ichthyol, potassium permanganate 1 in 500 to 1 in 250, argyrol 25 to 50 per cent., protargol 10 to 20 per cent. Visible reactions must be had, such as the white stain of nitrate of silver, the brown of iodine and the black of ichthyol, argyrol or potassium permanganate. Exuberant granulations are burned off with caustic strengths. In the catarrhal stage, when infection is absent, the astringent concentrations are indicated in about a third strength or less of the foregoing solutions. Ultzmann's solution as employed in the male, in the same or double strength, is good. Repetition is better than undue strength of application and due time must be permitted for the formation and casting of the superficial slough and for healing of the mucosa before another treatment is given.

The tampon is of value as in vaginitis and employed in the same manner. A thin mass of cotton is thoroughly saturated with the drug and then wrapped carefully about the cervix for full absorptive and decongestive action. What might be called counterinoculation may be tried with yeast or lactic acid bacilli. Reports in literature are contradictory. The probabilities are that it may succeed in some cases and fail in others. Abraham<sup>1</sup> and Menge<sup>2</sup> employed yeast in any case and Martin<sup>3</sup> in pregnancy. Watson<sup>4</sup> employed lactic acid bacilli.

The technic with yeast is a clean, dry vagina after a normal salt solution douche and the yeast powder, previously sterilized or not, is either insufflated into the cavity of the vagina and cervix or applied heaped liberally on a tampon. Abraham states that he reinforces this treatment with a glycerin suppository rich in yeast.

<sup>1</sup> Monats. f. Geb. u. Gyn., vol. xxxi.

<sup>2</sup> Hand. d. Geschlechtsh., Vienna, 1910.

<sup>3</sup> Berl. klin. Wchnschr., 1904, No. 13, pp. 325 and 329.

<sup>4</sup> British Med. Jour., January 22, 1910.



The Watson procedure obtains whey by filtering sour skimmed milk. Salts, lactose, lactalbumen and abundant lactic acid bacilli are in the whey, which may be reinforced with powdered lactic acid. Daily treatments with either the yeast or the bacilli method are necessary until the gonococcus remains absent.

The author has tried bougies containing active lactic acid bacilli in the male, in various stages of gonococcal urethritis. The results seem to be that the bougie as a foreign body excited the urethritis more than the lactic acid bacilli destroyed the gonococci. This is rather the logical outcome because such foreign body offence begins with the moment of introduction of the bougie into the inflamed canal, whereas inoculation and growth of the bacilli upon the mucosa require at least many hours. The latter process is handicapped by such a lapse of time. He has long ago abandoned the method as a virtual failure.

The surgical measures are nonoperative and operative. Chief among the former is dilatation of the canal with the Hanks sounds, as needed, and already described. The minor operative technic are incision and cauterization of the nabothian cysts when they occur and the curettement of unhealthy granulations and cauterization of deeper lesions in Hunner's method. Douches and tampons should always follow such procedures. Trachelectomy is the one major operation available for destructive lesions in the cervix. For details of this operation the reader is referred to works on gynecology.

The Hunner technic<sup>1</sup> is selected for deep lesions with intractable symptoms. A speculum, tenaculum, thermocautery or electrocautery, tampons, gauze and dressing forceps are required. The patient is prepared by douching and drying the vagina and by securing the cervix with the tenaculum between the blades of the speculum. General anesthesia is never used and local anesthesia only when the cervix is very sensitive. The Sims' position and speculum are best. The cautery at dull red heat is drawn evenly along the axis of the cervix, burning not too deeply and not more than 2 to 5 mm. with a respite between each stroke, which number a half-dozen or less. Packing is used for bleeding or discharge. Repetition is after three weeks, permitting full healing and restitution so far as possible. Ten sittings are usually sufficient. The method is dangerous except in the hands of an expert, because the burns may readily be too extensive. A small cervical drain attached to the vaginal gauze with the removal of both at the end of twenty-four hours is good practice.

Curettement of the cervix followed by the applications just noted may be done. It usually requires repetition every two weeks for several sittings. As a rule it is combined with uterine curettement.

*Aftertreatment.*—Gonococcal cervicitis in general requires continuation of treatment for many weeks. It is of slow progress toward cure and does not suddenly cease. There is usually a catarrhal afterstage

<sup>1</sup> Jour. Am. Med. Assn., January 20, 1906, p. 191.



which sometimes requires as much attention as the infective stage. In the immediate aftertreatment there must be no intercourse and the surgeon must keep the case under careful observation and frequent bacteriologic test. The remote aftercare is an occasional report to the doctor's office with a bacteriologic examination. If the woman is married or is living with a man and if she has resumed regular sexual relations with him without infecting him, then this fact becomes the best of all tests because it is a physiological test.

**Cure.**—Gentle persistent judicious measures with full coöperation by the patient will induce a cure. Cervicitis in many of its features is analogous to prostatitis in the male. The pathologic cure is often secured and without permanent lesions except in the crypts, and the symptomatic cure is usual in intelligent patients. The bacteriologic cure must be absolute after repeated tests and may embrace also the hemologic tests. It may be present although a slight noninfectious catarrh may persist. The woman must be examined in the quiescent and excited states as discussed in the general subjects of prophylaxis, and intercourse must not be had until the organisms have been consistently absent for at least three examinations at long intervals, such as monthly. The complement fixation test is important, especially as in the long and severe cases it is apt to be present. The negative reaction is desirable.

#### GONOCOCCAL ENDOMETRITIS.

**Significance.**—Significance regards the factors of extension and results of the disease within the womb. The gonococcus advances directly along the mucosa from the cervix to the endometrium in severe cases, being hindered by the narrow internal os, the plug of mucus and the gravitation of the uterine mucus and other secretion outward against the line of attack. As in all gonococcal lesions the endometrium is profoundly altered in any severe and in many average cases so that sterility, dysmenorrhea and other disturbances of this function are seen.

**Varieties.**—The varieties are as to course acute, subacute and chronic, as to organisms nongonococcal and gonococcal and as to sequels uncomplicated and complicated.

**Etiology.**—The etiology is in the predisposing factors anything which contributes to uterine congestion in the form of catarrhs, lacerations, displacements, deformity and the like. Uterine disease secondary to miscarriage and abortion is a potent element, likewise physiological congestions of menstruations and puerperium. During menstruation the mucosa is congested, and the plug of mucus is absent or free, depriving the womb of its protection, and after childbirth or miscarriage the same condition is present in more pronounced degree so that an old infection of the cervix by lighting up or a new infection may advance into the endometrium.

The exciting cause is always the pus-producing organisms, of which

niefly concerned with the gonococcus although the Streptococcus and the Staphylococcus pyogenes are equally common and yet less usually sexually acquired in that they are seen in birth and miscarriage. Meddlesome office instrumentation, at the vogue, may be the indirect or direct cause of infection. The influence is slight in and removal of the plug permitting transit of gonococcus and its direct transmission of germs on the face of the instruments in the vagina or cervix is present in the lower part of the endometrium.

**Fig. 126.** — The pathology of gonorrhea traces the common acute, chronic and chronic nongonococcal varieties, the latter is the type of gonorrhea, and the essence of the process duplicates that of all infections with this germ, although the process is modified by the pyogenic germs which complicate it in every step of its progress. The presence of the gonococcus in the tissues involved is usually the endometrium and primarily the metrium, but in severe cases escape with invasion of the uterine muscularis.

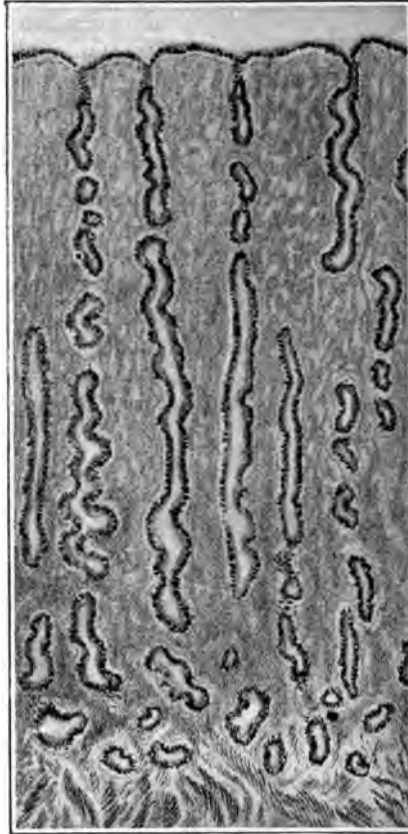


FIG. 126.—Normal uterine mucosa in a woman, aged twenty-five years. Four main glands are shown. The small cross-sections are branches of the main gland. The glands dip down to and very little into the muscularis, 40 diameters. The fact that these mucous glands are branched and compound and penetrate into the muscularis demonstrates the importance of gonococcal invasion. (Dudley.)

*Acute endometritis* is characterized by exudate and trophic changes as its temporary lesions.

They may be restituted or go on to trophic changes which are the most common, at least in the chronic cases. The conditions are entirely so that macroscopically they are redness, edema, and hemorrhages, combined with

trophic lesions of a thin, rather than a thick mucopurulent or purulent discharge bathing the surface and redundant with gonococci. The trophic elements are the exfoliation of epithelia promoting a rough surface, disseminately or diffusely. Microscopically are the hemorrhages, numerous red and white blood cells and small

<sup>1</sup> Principles and Practice of Gynecology, 6th ed., 1913.

round cells invading the mucosa in the circulatory, trophic, glandular and lymphatic pathology. The circulatory changes present the hyperemia, swelling and edema and the dilated vessels extending into the muscle coat. The trophic disorganization is the loss or multiplication of cells of the epithelium, superficial ulcers and thickenings and cellular substitution shown in atypical size, form and staining of the elements. The glands may more or less escape or be profoundly changed, so that every possibility from normal, contracted, enlarged, cyst and abscess cavities are seen. Their epithelia are modified but less than on the surface of the endometrium and usually exfoliated or thickened. The stroma of the mucosa is invaded with white and red cells, serum and alteration of its essential cells and the lymphatics passing into the myometrium are engorged with inflammatory products.

The permanent lesions are the same as those produced by the gonococcus in every mucous membrane and are represented by loss, substitution and contraction of epithelia of the glands and the surface and in more or less persistent catarrh.

*Gonococcal chronic endometritis* is usually a positive degree of the permanent lesions of acute endometritis, having the essence of chronic productive inflammation, disseminate or diffuse, so that there are thickenings or atrophy or the mucosa may be nearly normal. Macroscopically are unevenness and irregularities of surface with many polypoid areas and granulations, with indolent hyperemia and exudation. Microscopically the epithelia, glands, stroma, vessels, lymphatics both the endometrium and myometrium are changed. In the superficial mucosa are cellular loss in desquamation and ulceration, multiplication in thickenings, granulations and polypi and substitution in metaplasia—columnar cells being either atypical or displaced by squamous cells. The glandules are enlarged, hypertrophied, compressed or atrophied, patent or occluded with cystic or abscess development. Their epithelia are lost, multiplied or substituted exactly as on the surface but in much less degree, and secretion is absent or altered, becoming thick, mucoserum filled with white or red bloodcells, desquamated epithelia, detritus and pus in which the gonococcus may or may not be present. The stroma is infiltrated with red and white bloodcells and small round cells and often so hypertrophied as to group the glandules abnormally, crowding many together and separating others. The stroma is further modified by vascular hypertrophy and multiplication extending even into the muscularis, which is invaded in the same way along the course of the bloodvessels and lymphvessels, constituting the early degree of metritis.

The associated lesions of both acute and chronic endometritis are other gonococcal foci in the internal and external reproductive organs, especially metritis, salpingitis, ovaritis and peritonitis in severe cases, and the complicating lesions are of the systemic and urinary type involving the urinary organs above the bladder.

**Symptoms.**—The symptoms are acute, subacute and chronic, subjective and objective, local and systemic and vary with invasion, establishment and termination.

*Gonococcal acute endometritis* has circulatory, sensory, exudative and functional disturbance in the invasion, which is usually less marked than in many other gonococcal lesions. The circulatory excitement causes the indefinite weight, dragging and pain of the early days and is involved with the exudation in the subjective local outbreak. The functional derangement of the menses is that they are checked or decreased, excited or prolonged. Vaginal and cervical discharge is at first decreased and then with the establishment increased like that from the endometrium and all the other symptoms. In these respects the discharge behaves exactly like that from the male anterior urethra when the prostatic urethra becomes involved, as already explained. With the continuance of the inflammation menstrual disorder is prolonged or augmented.

The objective local signs are classed as circulatory, exudative, sensory and functional. Congestion of circulation enlarges and softens both the body and cervix of the uterus and commonly opens the os externum so that it gapes and is filled with exudate. The discharge is thin and serous, differing from that from the cervix, which is mucous and stringy. Admixture of the cervical and endometrial discharge is copious, moderately thick and somewhat stringy, whitish or positive yellow according to the mucus or pus present and its constituents are mucus, pus, red and white bloodcells, epithelia, detritus and organisms, notably the gonococcus. Tenderness is often found in the body, cervix and annexa of the womb and the functional disturbances complained of by the patient may be corroborated by observation. Instrumental examination of the endometrium is meddlesome and dangerous and no longer practised by experts.

The subjective and objective systemic symptoms may be absent in mild cases but are usually present and moderate or marked according to severity. They are those of all septic and absorptive conditions—ill or chilliness, anorexia with nausea or vomiting, diarrhea or constipation, fever which is usually moderate and always variable in its stages, circulatory and respiratory excitement, malaise and prostration.

The termination varies with severity. The mild cases may go on to practically complete anatomical and physiological recovery but these cases are rare because the gonococcus has a locally destructive power. The average severe case is apt to pass into more or less typical chronic conditions with the symptoms described under chronic endometritis and intense cases during their acme or even subsidence may develop extensions into the myometrium, tubes, ovaries and peritoneal cavity. *Gonococcal Chronic Endometritis*.—This lesion is one of grave significance to the woman in the anatomy and physiology and, like *vicitis*, to the community in the infectiousness which it retains for long periods. Its etiology is that of a prolongation of an acute attack of direct origin in a subacute or semichronic onset. Either may be or be associated with the acute form exactly as has been stated. Likewise as in the cervix, chronic endometritis may have a low-grade

persistent or slowly progressive quality or numerous relapses and exacerbations dependent on the normal processes of menstruation and labor, or on the accidents of miscarriage and abortion or on meddling some and septic instrumentation or on trauma by manual examination. Any of these factors by producing hyperemia or breaks in the surface of the mucosa open the portal for entrance of the disease as a relapse exactly as a primary attack.

Symptoms are as in all cases subjective and objective, local and systemic. Exacerbations have all the elements of fresh acute outbreaks. The subjective local symptoms are exudative, sensory and functional. The discharge is the most prominent persistent and significant complaint. Its quantity is considerably less than in the acute stages and its quality is less tenacious, stringy and purulent owing to the mixture of the endometrial and cervical mucus and the gradual subsidence of the purulence. Its constituents are otherwise the same: red and white bloodcells, puscells, epithelia, detritus and organisms of which the gonococcus is most important but often very difficult to detect and a large number of negative specimens alone tend to prove its absence as shown under diagnosis. The sensory conditions are slight except during an exacerbation, when they duplicate those described under acute endometritis. The functional derangement concerns menstruation, impregnation and pregnancy. Any possible change in menstruation is seen. Painlessness may become severe dysmenorrhea. Scanty may become profuse, and profuse may change to scanty or absent; so that dysmenorrhea, amenorrhea, menorrhagia and even metrorrhagia are not uncommon as alterations of previously normal menstruation. Changes in the endometrium make impregnation impossible so that relative sterility is seen or if conception occurs the same lesions lead to abortion.

The objective local symptoms relate to the other sexual organs and the peritoneum and are physical, functional and exudative. Signs of the gonococcus are easily seen in the urethra, vulva, vestibular glands and cervix. The body of the womb is enlarged, softened from chronic congestion, somewhat tender and often altered in flexion and position. If the case has been severe, metritis is present and augments these otherwise indefinite and variable signs and also lesions in the annexa and pelvic peritoneum may offer abundant objective findings in enlargements, deformities and adhesions. The discharge has a thinner consistency, less purulence but the same microscopic and bacteriological findings as noted in acute endometritis. Corroboration of complaints concerning menstrual disturbance, sterility and abortion is definite and often easy.

The subjective and objective systemic symptoms are usually lacking or insignificant; when present they are more apt to depend on extension of the disease into the tubes and peritoneum or on complications in the upper urinary tract than on the endometritis itself.

The termination is a very uncertain matter. Anatomical recovery is probably never seen in that portion of the mucosa and glands at

profoundly changed. Physiological recovery in mild cases is sometimes observed but the average chronic infection leaves permanent changes and persistent symptoms. These may be only a mild catarrh or a lapsing mucopurulent or purulent leucorrhea or incurable dysmenorrhea. The sequel of sterility or frequent abortion is very important and finally the infectiousness of the woman in intercourse is often a menace for many years.

**Diagnosis.**—Diagnosis of *gonococcal acute endometritis* due to the gonococcus is usually not difficult. The history affords admission of contaminating intercourse and the progress of the disease from the urethra and the vulva upward or its appearance in these parts at about the same period. The subjective complaint is dragging pain, free discharge and altered menstruation combined with the objective sign of an enlarged uterus and of gonococcal pus in the urethra, vulva, vestibular glands, vagina and cervix. The laboratory specimen detects the gonococcus in one or more specimens and recognizes the character of the constituents of the pus, especially the mucoserum, as contrasted with the thick mucus of the cervix and the ciliated epithelia. Numerous specimens must be negative for the gonococcus and positive for other organisms before the disease is called nongonococcal, and in severe cases the gonococcal complement fixation test if positive is of great value. The treatment of the endometritis itself is not of much diagnostic meaning but that of the associated gonococcal lesions is contributive of proof.

*Diagnosis of gonococcal chronic endometritis* in exact sense is difficult. It must recognize focal inflammation in contrast with cervical involvement and with cervicitis and endometritis together. The subjective symptoms are of little weight beyond suggestions, as they are alike in cardinal characters in all forms of endometritis. Objective invasion of the uterine cavity with catheters or other instruments for diagnosis is no longer practised, so that one is compelled to rely on extensions of the infection into the tubes, ovaries and peritoneum as important proofs, because they are such common associates. Treatment alone is final because operative and revealing the exact pathological process within the pelvis.

**Differential Diagnosis.**—The differential diagnosis chiefly concerns acute endometritis, tubal extension and degenerating fibroids.

*Tubal extension differs from gonococcal acute endometritis* in always having a history of severe onset, rapid progress from the external genitals to the uterus and from the uterus to the tubes and pelvic cavity. The subjective symptoms are ovarian pain associated with intense systemic symptoms of infection and absorption and a distinct tendency to bowel and bladder disturbance. The objective lesions must be determined by the most gentle possible examination, because violent manipulation in this acute disease may convert a congestion into a suppuration of the tube or extend early tubal lesion to the ovary and the peritoneum. The observer must be satisfied with a sense of fullness and tenderness in the tuboövarian region, the fornices of the vagina and loss of mobility of the cervix. Rectal examination will often demon-



strate what the vaginal touch fails to do. Manifestly specimens from the tube cannot be obtained for the laboratory except at operation, which is no longer contemplated in acute stages. Treatment is of value in that, as acute symptoms subside and chronic signs supervene, a fuller physical examination is possible and the invaded tube may be exactly outlined. At operation the condition is evident and the bacteriologic study of the tubal contents may be carried out.

*Degenerating tumor differs from gonococcal acute endometritis* in having a history which is never acute, denies infectious intercourse and gonococcal conditions elsewhere in the urinogenital tract. The subjective symptoms are those of indefinite sensations. Bleeding is the most prominent sign, which may be early but is usually late. Thus menstruation is made excessive and often metrorrhagia appears late. With ulceration during the degeneration, shreds of tissue may be cast and should always be submitted to the laboratory. The objective signs are those of irregular enlargement of the womb with softening but with little tenderness unless ulceration is present. Subperitoneal, cervical and mural nodules may be present and contribute much to the diagnosis which is settled by the treatment at operation.

**Treatment.**—Variations must be adopted to the acute stage, in which the expectant method predominates, and to the chronic stage in which numerous details are available according to conditions.

The prophylaxis is personal and social. The personal protection through great cleanliness of the hands and dressings concerns the eyes and the vagina, vulva and urethra below and the tubes above the lesion, through the utmost absence of excitants, either physical, physiological or therapeutic. The social prevention burns the dressings, requires special utensils, toilet articles, bedding and the like and forbids intercourse. Abortive measures are unknown, because the endometrium is inaccessible to any such attempt.

The essentials of management are described in Chapter IX on General Principles of Treatment on page 483.

*Curative Treatment.*—All effort is chiefly expectant and comprises gentle measures, guiding and aiding Nature's processes rather than instituting great reactions of their own. Thus the tendency to increase and extension of the lesion are avoided. The associated lesions, almost always antecedent, in the urethra, vulva, vagina and cervix have attention at the same time.

The physical measures are only hydrotherapy for thermal and cleansing effects. Its local administration is either cold or heat according to the comfort of the patient and secured by the ice-bag or coil or the hot-water bag or coil over the lower abdomen. Alcohol sponge-baths soothe the patient and limit the distress of fever. The douches must have the same preliminary details as those laid down for vulvitis and vaginitis and they fulfill the same indications in cleanliness, antiseptis and decongestion. The sitting posture on a douche-pan is best, to avoid as far as possible penetration by the current or gravitation of retained fluid into the uterus. The pressure should be moderate



d the nozzle should provide well for the return flow. No nozzle is better than the double-shank glass type with a long and wide space between the two shanks through which the outflow occurs.

The posture for drainage is important and may be sitting, lateral, dorsal or ventral. Fowler's position, incomplete or practical in degree according to need and comfort of the patient, is available for retropositions, likewise either of the lateral positions. The dorsal or the ventral positions may be alternated for anteropositions. Observation of results will alone determine and the patient's comfort must not be broken because such irritation may augment the disease.

In its systemic application hydrotherapy offers sitting baths to relieve congestion and stasis and body baths to soothe and cleanse.

The medicinal measures are systemic and local. The former are not largely demanded or serviceable, except anodynes for severe pain, sedatives for undue congestion, supportives for prostration and tonics for depreciation in the long cases. The local means are in the acute period only the vulvar and vaginal douches, at first cleansing, then antiseptic, as the case improves.

The surgical procedures are omitted in the acute period in all cases but become important in many forms of gonococcal chronic endometritis. Acute endometritis often becomes chronic like other gonococcal infections.

*Gonococcal Chronic Endometritis.*—As in the acute lesion the management is moderated according to circumstances.

The physical measures are massage and hydrotherapy. Massage is only for the boggy uterus late in the catarrhal stage without infection. As in the prostate its benefits may be great and should be tried. Local hydrotherapy offers hot, long douches which benefit the congestion and relaxation of the organ but do not reach the infected mucosa. All their details are fully discussed under vaginitis, page 544. General hydrotherapy comprises the sitting baths and the body baths which when properly given are soothing and decongesting and fulfill their other usual indication. Their influence on the infection is indirect.

The medicinal measures are given systemically and locally. By systemic administration the system is supported against anemia, debility and absorption by the usual selection of hematinics, stimulants and eliminants. Ergot may be given with or without either hydrastis or viburnum prunifolium or both, for a relaxed uterus, such as would be benefited by massage. Serumtherapy, as in cervicitis, may be tried but is of little value. The more chronic the stage the greater the value of bacterin. A severe negative phase should never be provoked. Serum is suggested for the acute period. All details are described under the general subject of serumtherapy on page 512.

In the local administration the medicated douches described in vulvitis and vaginitis are available. Direct uterine applications are of great value but must be used with utmost aseptic, physical and chemical caution. The greatest danger is in office treatment when cervical drainage is not efficient. Applications are best during the few

weeks after a curettement while the cervix remains wide open for drainage. Some authorities prefer to omit them. They had best not be tried without instruction or experience. As preliminaries examination must exclude infection of the tubes, ovaries and peritoneum. The vulva and vagina are carefully douched with the solvents and destroyers of pus and then with gentle methods under strict antiseptic precautions the slug of mucus is removed as in cervicitis and then the endometrium is swabbed in the method described for chronic endocervicitis on page 553. The entire lining should be gently but thoroughly reached with special reference to junctures of the anterior and posterior walls to form the roof and two lateral walls. The cervix must provide free outlet for excess of fluid.

So-called counterinoculation, following the same method in the vagina and cervix, has been attempted by Brindeau<sup>1</sup> with the bacillus of lactic acid. Foul exudate is said to have been promptly overcome in 14 endometrites and in 78 women with other gynecologic conditions.

The surgical measures are nonoperative and operative. Among the former class is chiefly dilatation of the cervix for drainage and indirectly the applications and instillations. The operative measures are curettement without or with trachelectomy. The full details of these operations are left to works on gynecology but the following general features of curettement should be remembered. The case should be one of indolent irresponsive symptoms and defective drainage and the time of election for the operation is just before the monthly period when the soft hypertrophy of the mucosa renders its removal easily more thorough. There should be no tubal or ovarian disease. The instruments and supplies are a speculum, tenaculum, uterine probe, cervical dilators, assorted, sharp and blunt curettes of either irrigating or nonirrigating type, irrigator and intrauterine douche nozzle, dressing forceps, gauze, swabs, antiseptic solution such as iodine, vulvar pad and T-binder. The preparation of the patient should be that accepted in all hospitals as to catharsis and the like. The vulva should be shaved and a very careful scrubbing and douching of the vagina given. The anesthesia is general and the position lithotomy. The landmark is the cavity of the uterus whose form, direction and depth are determined by the uterine probe, after the speculum is inserted and the tenaculum attached to the cervix. The probe should touch nothing before it is in the cavity of the cervix. The curettes should all be bent to conform with the shape of the probe. Dilatation of the cervix precedes the probing and is done with the Hanks or Goodell instrument. The scraping is then begun of both cervix and body and irrigation had best be omitted unless the cervix is wide open, the return free, the pressure low and the operator experienced. Step by step from a fixed starting-point the posterior surface, lateral edges, tubal outlets, roof and anterior surface are all gently but deeply curetted with strokes which travel from the highest point to the os internum and which

<sup>1</sup> Arch. mens. d'obst. et de gyn., March, 1912.

ch the muscular coat, recognized through the resistant feel and her harsh sound. The blunt curette or the irrigation removes thebris and the cavity is mopped clean and dry by sterile gauze wrapped the smallest instrument or the probe and vigorously drawn over surfaces from above downward. The lining of the cervix is treated the same manner and then packing for five or ten minutes stops œdema. Iodin or similar antiseptic is then painted over the entire vity or a few minims may be instillated and allowed to flow out upon e vaginal pad previously placed in the posterior cul-de-sac to receive y specimen and such leakage. A small drain soaked in iodine may inserted for the first four to eight hours. Other applications recomended are nitrate of silver 10 per cent., potassium permanganate per cent., formalin 25 to 40 per cent., ichthyol full strength, carbolic id and alcohol, 50 per cent. alcohol, picric acid and the like. Drains, inserted, should be tied to the vaginal gauze and both removed within few hours or uterine drains may be omitted if the cervix is wide open nd only the vaginal gauze used, which in that case may remain in for ne day.

The aftertreatment of curettement is for the early days rest in bed. he Fowler's position probably improves the drainage and vulvar vage should be practised after each urination and defecation. Vaginal ouches in the sitting position may be given if the drainage is copious, ith all the technic and precaution described for douches during endo- metritis. The usual postoperative diet, drink and nursing are required. n the remote aftercare the catarrhal stage may be important and equires caution during the menses. Menorrhagia may occur during he first few months and is controlled by uterine sedatives variously ombined, such as ergot, hydrastis and viburnum prunifolium. Sexual elations are postponed until late and there must be no infection in the oman or in the man. The latter condition may readily cause a rein- section. The dangers of curettement are a failure to remove all the iseased mucosa, which will light up the disease upon the raw surface, arry it into the myometrium or extend it into the annexa. The autions are, therefore, thorough removal of the mucosa with steriliza- ion of the denuded surface, free drainage of any exudate and a clean agina and vulva before and during the operation and in the aftercare.

*Aftertreatment.*—Gonococcal endometritis requires persistence of eatment for long periods owing to its severe character and slow rogress. Uterine catarrh is a very common sequel and may be almost npossible to relieve completely. In the immediate aftertreatment itercourse is forbidden and the urologist keeps the case under observa- on and repeated bacteriologic test. The remote aftertreatment is casional visits to the office for these examinations. Women living legal or illegal marital relations may be regarded as cured if they do t infect the men.

*Cure.*—The majority of cases are completely relieved, which means t the patient must be free of infection, constituting the bacterio- ic cure. A negative complement fixation test is also advisable.

The endometrium often recovers so that childbearing is possible, but sterility is the rule after gonococcal infections so that in this sense pathologic cure is often not seen. Symptomatic cure is relief of pain associated with or independent of menses and relative or absolute freedom from discharge.

### GONOCOCCAL METRITIS.

**Varieties.**—The usual subdivisions as to course are acute and chronic complicated and uncomplicated. Subacute forms cannot be distinguished. As to occurrence metritis is always secondary and never primary, and as to involvement it may be superficial or deep, general or disseminate, respectively involving the myometrium or focalized in one or a few points.

**Gonococcal Acute Metritis.**—**Significance.**—Significance rests chiefly in its presence as the extension of acute or chronic endometritis and as the sign of severe forms of infection.

**Etiology.**—The etiology is always a severe endometritis rapidly extending along the mucosa and penetrating beneath it usually in a soil rendered fertile by physiological processes such as menstruation and childbirth or by pathologic incidents such as miscarriage and abortion. The gonococcus is the exciting factor with or without its allies of the pyogenic group, notably the streptococcus, staphylococcus and the *Bacillus coli*. The degree of infection is, as in all other invasion, dependent on the virulence and number of organisms invading and the resistance of the patient, either as idiosyncrasy toward the gonococcus and pus organisms or as general low condition of health. The presence of the gonococcus in the uterine muscularis was demonstrated by Madlener.<sup>1</sup>

**Pathology.**—The pathology represents advancement of the gonococcus from the mucosa of the endometrium into the muscle layer of the wall of the uterus and the essence is the characteristic change embodied in hyperemia and cellular stimulation of the muscle substance during the acute form and in congestion and cellular substitution during the chronic form. Macroscopically are shown congestion, softening, enlargement and often involvement of the uterine annexa and microscopically are seen changes similar to those of endometritis with the exfoliation omitted as there is no surface exposed. These temporary lesions may fully subside but the permanent lesions are the infiltrations and cellular changes concomitant with the parallel conditions in the endometrium. The associated lesions are regularly endometritis, salpingitis, oöphoritis and peritonitis, because an infection sufficiently active to attack the myometrium has its origin in the endometrium and almost always extends promptly to the tubes, ovaries and serosa.

In the chronic form the changes may be a submucous penetration

<sup>1</sup> Cent. f. Gyn., 1895, No. 50.

the disease diffuse or disseminate, or it may be a deep general penetration into the muscular substance in various sections of the organ in the muscularis as a whole. In some instances the endometrium found recovered, more or less completely, while the myometrium one is diseased. In other cases both the endometrium and the myometrium are similarly and equally affected in their general extent in various portions only.

**Complications.**—The complicating lesions are those of gonococcal disease in the system at large or in the upper urinary tract, as is the case in all other intense and progressing manifestations of this organism.

**Symptoms.**—The symptoms are subjective and objective, local and systemic and vary with the periods of invasion, establishment and termination. The character of the infection as a sequel of endometritis makes it almost impossible to recognize the invasion unless a lightening up of all the symptoms characterizing the endometritis and especially of those in the system at large suggests an extension of the process which is found not to be in the annexa of the womb. The subjective local symptoms are, therefore, those of the antecedent endometritis augmented in degree, prolonged in course and resistant to treatment. The invasion is typically septic when present—chill or chilliness, anorexia with nausea or vomiting, diarrhea or constipation, excited pulse and respiration and a fever with wider daily variations. The establishment possesses sensory, functional and exudative elements. There is dragging and heavy feeling in the milder cases advancing to real pain in the more active cases and the function always shows excessive and otherwise disturbed menstruation and even lactation may be decreased or abolished as in any other septic process. The exudate of endometritis is at first decreased, much as that of urethritis in the male is decreased when the prostate becomes involved and later it is greatly increased and altered. Hemorrhagic quality may be added and alarm the patient, sometimes as fresh, oftener as dark altered blood.

The objective local symptoms through the speculum show the cervix soft, boggy, patulous and dilatable, combining endocervicitis and myocervicitis. The discharge after the temporary decrease of the invasion is copious, purulent and bloody or at times mucopurulent and seropurulent varying with the free quantity of uterine as compared with cervical elements. Like the cervix, the body of the uterus is soft, distinctly tender and generally or locally enlarged. The associated lesions are easy of detection and comprise the antecedent gonococcal foci in the external and lower urinogenital organs and of concomitant or secondary involvement in the oviducts, ovaries and pelvic peritoneum—each with its familiar and typical physical signs.

The termination in the mild cases only is a slow subsidence of the acute symptoms and a possible recovery but the tendency and common experience as in all other gonococcal lesions is for chronic metritis to supervene. As stated under pathology the endometritis may practically or actually recover before the metritis does, but the rule is for

these two conditions which are mutually causative in their relation to have the same course and termination in a low grade of chronic disease.

**Gonococcal Chronic Metritis.—Significance.**—Significance may be regarded as the final degree of gonococcal disease so far as the uterus itself is concerned and is therein analogous with the chronic gonococcal invasions of the prostate in the male.

**Etiology.**—The etiology is the gonococcus without or with its allies of the pyogenic group which after having caused a severe and extending endometritis reaches the myometrium.

**Pathology.**—The pathology has been fully discussed under gonococcal acute metritis in drawing a comparison between it and the chronic form.

**Symptoms.**—The symptoms are subjective and objective, local and systemic and are peculiar in the absence of any invasion unless the prolongation of the acute symptoms may be regarded as the period. Ordinarily the lesion may begin as a subacute or chronic process so that establishment is the period at which the disease is usually seen. The type of symptoms is that of chronic endometritis higher in degree, more prolonged and more profound in their pathogenic basis. The subjective local symptoms are sensory, functional and exudate. There is much more pain in the progressing cases and higher discomfort in the stationary and indolent cases. Menstrual function is more profoundly and obstinately changed and metrorrhagia is by no means uncommon. A persistent characteristic leucorrhea is often the chief complaint. The objective local symptoms are a cervix, in speculum, compromised by chronic congestion so that it is soft, relaxed, patulous and filled with exudate. The body is enlarged uniformly and in all directions and there is much tenderness not so acute but more constant and enduring than in the acute stage. The discharge is characteristic exactly like that of chronic endometritis with the element of hemorrhage rather frequently added.

The termination is a questionable factor. The mild cases may recover with little serious anatomic or physiologic change but the average case has no cure in the full sense in that chronic catarrh or low-grade suppuration with or without relapses is the rule. Menstrual disorder persisting for the remainder of the woman's sexual life, with sterility or frequent miscarriage and abortion, is the usual sequel, typifying the profound damage of the endometrium and myometrium.

**Diagnosis of Gonococcal Metritis.**—The diagnosis of acute metritis is a very important but a rather difficult matter. In the history are the factors of infecting coitus or in married women of gonococcal disease of subacute or chronic type in the husband, from which proceeds the story of urethral, pudendal and vaginal signs with the significant addition of rapid extension, early uterine involvement and perhaps finally annexal disease. The subjective symptoms are the deep-seated heavy pain, discomfort and discharge with prompt and violent menstrual disorder, and the objective signs are those of obvious sys-

ic infection with its prostration and fever. The cervix and uterus much altered from the muscular invasion and often the annexa are involved. Such extension to the annexa associated with profound uterine changes is most important in the diagnosis. The laboratory dily discovers the gonococcus in the discharge from the cervix and externalia and later the positive gonococcal complement fixation test may be elicited. The blood count of pus process is helpful if pyogenic organisms are present but may be less manifest with the gonococcus alone, much as is seen in prostatic disease of the male. Success of antigenococcal treatment in the urethra and externalia is a suggestion but not a positive proof of, the nature of the infection which may be mixed and not pure. Anatomical diagnosis is often supplied only by operation.

**Differential Diagnosis.**—Differential diagnosis defines gonococcal acute from pyogenic acute metritis. It must be remembered that these two forms are often associated.

*Pyogenic (streptococcic) differs from gonococcal acute metritis in its history of infection after miscarriage, abortion or childbirth rather than after illicit intercourse, with its symptoms of urinogenital infection. Its onset is more intense and its progress more rapid and its penetration deeper, because its extension is by the lymphvessels and lymphspaces rather than the surface of the mucosa alone or by penetration after involvement of the surface. The gonococcus is typically superficial in its habitat and exceptionally deep, in contrast. The subjective symptoms may be little or marked locally; even in the most violent cases they may be insignificant. On the other hand, extreme systemic disturbance of advancing sepsis may be present both in the invasion and establishment and the objective signs are the blood count and pus process and a negative gonococcal fixation test. The lymphatics of the broad ligament and the substance of the broad ligament invaded while the tubes and ovaries themselves may escape. There are no gonococcal lesions in the external parts and such local lesions on the surface as may be apparent may be slight—out of all proportion to the severe systemic reaction. The laboratory detects the streptococcus, staphylococcus and colon bacillus but not the gonococcus. The complement fixation test for the gonococcus is negative and the blood count is positive for pus formation except in fulminating cases giving so much depression that a leukocytosis does not develop. The treatment along antigenococcal lines is of no avail and often the exact anatomical diagnosis cannot be reached without operation.*

**Treatment of Gonococcal Metritis.**—The plan is limited by the acute chronic stage and by complicated and uncomplicated lesions. The complications are the extensions to the appendages and peritoneum. Each is dealt with under its own heading.

The prophylaxis is the proper care, as already stated, of each lesion wherever in the sexual system with special reference to endometritis and cervicitis. Too violent and frequent treatment of these may be the source of the metritis. Care in every examination so as not to



traumatize the uterus is essential. Good management and careful treatment may do much to prevent an endometritis from involving the muscularis. Abortive measures do not apply.

*Gonococcal Acute Metritis.*—In the acute metritis, all the elements of management discussed in endometritis apply in hygiene, rest, exercise, diet, drink and nursing. The severity of the muscular invasion renders continuation of these measures rather longer than in endometritis.

The physical measures are also the same as in gonococcal infection of the lining of cervix and uterus. The vaginal douches are of value only for their heat effect on the uterus, and for soothing and cleansing the vagina and vulva. They cannot possibly reach the muscularis directly.

The ice-bag or ice coil or the hot-water bag or coil, during the early painful period is of great value. Sitting and body baths as soon as the patient may be moved for them complete the hydrotherapy. Massage may be employed only during the late chronic period for relaxation of the muscle but is forbidden if abscess is suspected. Posture must promote drainage of the pus into the vagina and from the vagina into a dressing. Its details are given under endometritis.

The medicinal measures are systemic and local. By systemic administration the infection is little influenced directly but catharsis, diuresis and diaphoresis are all of eliminating value. The relaxed and indolent muscle may be stimulated and toned by ergot and hydrastis. Pain and extension are controlled by opiates and belladonna. Serum-therapy is as yet none too exact. The serum may be of advantage in the acute period and the bacterin in the chronic stage. The local measures are the hot solvent and antiseptic douches. As stated under hydrotherapy, its influence is only indirect but is sufficiently great to make it worth while. When the metritis is at an end the persisting endometritis deserves the local measures already described.

The surgical treatment is variously regarded. The majority of authors teach that when in doubt nothing radical should be done and only expectant means employed. Findley<sup>1</sup> says: "The curette has no place in the treatment of acute metritis." There are the two dangers of the infection itself and of the operation itself. Safety indicates leaving the majority of these patients surgically alone. Dudley,<sup>2</sup> on the other hand, considers the cases as they show sapremia, bacteremia and septicemia or pyemia. Sapremia cases may be cleansed of the detritus with the finger as a curette and mopped clean with gauze. This operation is relatively safe. The bacteremic and septicemic cases had best be left alone especially if Nature is doing well. If Nature is not doing well and if possible benefit may come by cleaning the uterus, then according to observation by several authors including Pryor<sup>3</sup> and Krug,<sup>4</sup> rapid curetting with thorough sterilization of the

<sup>1</sup> Loc. cit., p. 439.

<sup>2</sup> Loc. cit., p. 216.

<sup>3</sup> New York Jour. Gynec. and Obst., 1892, ii, 86; Am. Jour. Obst., 1892, xxv, p. 598.

<sup>4</sup> Am. Jour. Obst., 1892, xxv, 822.

denuded surface with iodine or similar applications may remove the chief focus of absorption. As applied to gonococcal infection, any of the foregoing conditions involves mixed infections of which the bacteriology must be known.

*Gonococcal Chronic Metritis.*—All the principles of prophylaxis noted for the acute stage are used, being continued from the latter and there are no abortive measures. Chronic endometritis indicates the management of chronic metritis in the hygiene, rest before, during and after menses and during menorrhagia. Exercise is regulated for maintaining the acme of health and avoiding deep congestion. All the mild sports may be taken up progressing from walking and all the severe sports are avoided. Diet, drink and nursing are matters of familiar knowledge and have already been noted under chronic endometritis.

The physical measures are chiefly thermal in the form of hydrotherapy and heliotherapy. During the pain of menstruation the hot-water bag or coil or in rare cases the ice-water bag is of service. The douches are only indirect decongestants, likewise the sitting and body baths.

The heliotherapy is important and is applied over the pelvis encased in a sheet-iron box containing numerous electric-light bulbs and a thermometer. With an ice-cap or cold towel on the head, the temperature of the cabinet is raised to tolerance and without prostration or headache. The application is continued for from ten to thirty minutes and repeated every other day or so, according to result. The powerful hyperemic and actinic effects of the light and heat promptly remove the pain and dragging, absorb the exudate and decrease the discharge and other symptoms.

The medicinal measures are systemic and local. Except for support of the system in removing anemia and other signs of absorption, systemic administration is of little value. Local treatment is by douches and applications. Douches decongest indirectly by the action of heat and must, therefore, be hot, long and regularly given with rest in bed after them, as already noted under vaginitis. Their service in removing pus from the vagina and vulva is important. Applications are of service only in benefiting the antecedent endometritis. Their choice and technic are described under this subject on page 544. Findley<sup>1</sup> claims: "Formalin in full strength is an excellent antiseptic application. It penetrates deeply but is not known to cause stenosis. Formalin is applied by means of a swab." Injections are dangerous through possible penetration of the tubes and peritoneum, but instillations of a few drops of mild antiseptic may be tried if the return flow is not impeded. Drainage of the uterus must be good in all these treatments, as already shown.

*Aftertreatment of Nonoperative Metritis.*—All the principles of both immediate and remote aftercare are the same as in endometritis. The

<sup>1</sup> Loc. cit., p. 439.

most important element is personal and social prophylaxis in the certainty of removal of the infecting organism.

*Cure.*—The severity of a gonococcal disease which passes steadily upward into the myometrium necessarily leaves damage behind it so that pathological cure is probably very rarely secured. This is particularly true concerning the major operations which remove the foci and sequels of the disease but mutilate the patient by depriving her of part of or all her organs. Symptomatic cure may thus be reached, but its ideal is functional restoration, as in endometritis, without relapses, dysmenorrhea, sterility, extensions into the tubes and ovaries and a chronic leucorrhea. Bacteriologic relief implies absence of infection which rests practically on the organisms in the endometrium and hematology should show a negative complement fixation test.

*Surgical Treatment.*—The surgical treatment is nonoperative and operative. Dilatation, drainage and applications are the chief non-operative means, as elucidated under endometritis on page 562. Bier's method is said to be of value. A special cervical cup embraces the cervix through the vagina and the vacuum is made with peculiar syringe evacuating as the piston is pressed in. This is the method of Jayle and Loewy,<sup>1</sup> who apply the treatment daily for five-minute sittings in a total determined by the result.

The damaged uteri left behind by gonococcal metrites associated with other pus-processes are manifestly those which require major operations. Gonococcal metritis without complication in the appendages does not often lead to them, according to the majority of authorities.

The operative technics are curetting, amputation of the cervix and hysterectomy with or without the removal of the appendages.

*Curetting.*—This operation has been detailed as to technic under endometritis on page 565. It is selected for cases of menorrhagia rather than leucorrhea. The cavity should be painted with iodine or other mild stimulant and antiseptic at the operation and one or more times during the convalescence according to indications, and only in the presence of free drainage.

*Amputation of the Cervix.*—This form of treatment is reserved, in the selection of case, for some chronic cases in which the cervical and uterine mucosa are diseased and refuse response to treatment but in which the appendages are normal. Intractable endocervicitis with endometritis especially in the presence of lacerations sums up the indications. The instruments and supplies are a weighted speculum, vaginal retractors, uterine probe, vulsellum, scissors, scalpel, needle-holder, needles, ten-day chromic catgut, silkworm gut, dressings and T-binder. The preparation of field and patient is that accepted in any first-class hospital, including full shaving of the pudendum and vulva and toilet of the vagina. The anesthetic is general by choice and any ether-sequence is preferred in the absence of contraindications. The

<sup>1</sup> Presse méd., Paris, 1907, xv, 813.

re is lithotomy and the landmarks are the uterus whose depth, and position must be measured by the uterine probe and the h of the cervix determined. The anterior lip of the cervix is d with the vulsellum and a preliminary curettage with liberal cation of iodine is done in this operation as in all others upon uterus in the presence of any infection and especially gonococcal tion. The posterior lip of the cervix is then seized with the forceps the uterus drawn down as far as possible.

ie incision in the Schroeder operation is a bilateral median bifurca- of the cervix to the depth of the tear or obvious disease, thus ing an anterior and posterior lip. Sharp-pointed heavy scissors are for this incision. The amputation consists in removing each lip its free margin to near the base in a wedge whose base is distal whose apex is proximal. With the scalpel each lip is evenly incised side to side obliquely, passing away from the endocervical mucosa he inner flap and away from the vaginal mucosa for the outer flap st the posterior and then in turn of the anterior lip. Thus are left inner and an outer flap in each lip as originally made. The two r flaps are lined with the endocervical mucosa for most of their ice and the two outer flaps are covered with the vaginal mucosa. raw surfaces of the flaps must be opposed in order to create a new ical canal, external os and vaginal portion of the cervix. The res are placed for even apposition, without tension, constriction or , leaving the mucous surfaces intact and the vaginal surfaces plete and the canal patent. Ten-day chromic gut is preferred for e sutures but silkworm gut may be used. The dressing consists in a small uterine drain, which may be omitted, and vaginal gauze, dvar pad and a T-binder.

*Aftertreatment.*—The drain and packing are removed in twenty-four s. Douches are not employed except for special indications. The litions of the sutures must be known on about the fifth day and r removal is on the tenth or later day. These details are the ediate aftertreatment combined with the usual attention to the els, urine and bodily comfort of the patient by good nursing. ote aftercare is attention to the gonococcal infection as still ibly persisting.

*Cure.*—In the pathological sense the cure is removal of the chief n-bearing area. The new cervix should have good form and free d and in the symptomatic sense leucorrhea and menorrhagia should elieved. Bacteriologically in the final outcome the gonococci are nt.

*Hysterectomy.*—The following varieties are available: As to route nal and abdominal, of which the former is inadvisable in gono- al lesions of the appendages because, unlike the latter, the work ot be done under the eye; and as to degree the total and subtotal ations are recognized. In the former the whole womb with or out both appendages is removed and in the latter a wedge-shaped ent of the body is taken without or with the appendages in part or

whole according to indications. Kelly<sup>1</sup> in 1909 seems to have originated this technic and was followed by Beuttner<sup>2</sup> in 1911. Norris in his classic work, *Gonorrhea in Women*, ascribes it to Kelly while Findley<sup>3</sup> credits it to Beuttner. In total hysterectomy, therefore, the entire internal sexual organs including the cervix are ablated, while in subtotal hysterectomy that part of the corpus remains just above the cervix, with one or both tubes and always with one or both ovaries. One ovary must remain with considerable endometrium so that ovulation and menstruation will both be possible.

In the selection of case gonococcal endometritis and metritis must be obvious, the lesions profound, the annexa extensively involved and no results possible with other treatment, for determination of total hysterectomy. The other or subtotal hysterectomy is indicated in young women for whom ovulation and menstruation are very important. The womb is less diseased and at least one ovary practically normal and one or both tubes the chief site of complication so that the fundus of the corpus uteri with the tubal implantation and the affected ovary are ablated. Damaged uteri left by gonococcal metrites with or without other pus processes are manifestly those requiring either of these major operations.

The preliminary curetting is in order with free use of iodine and with packing of the uterus and suture of the cervix according to the form of hysterectomy chosen.

*Total Hysterectomy.*—Among the instruments and supplies are scalpels, scissors, hemostats, long forceps, skin and parietal retractors, broad ligament clamps, sponge-holders, ligature carriers, ligatures and sutures, peritoneal and skin needles, needle-holders, dressings, adhesive plaster and binder. In the preparation of field and patient iodine is applied to the skin after shaving the abdomen and vulva and the vagina must receive a special toilet and may be left lightly filled with iodoform gauze. The anesthetic is always general with one of the usual ether sequences. The posture is at first dorsal followed by partial or full Trendelenburg position. The superficial landmarks are the symphysis pubis below and the umbilicus above. The deep landmarks are the uterus itself, with the broad ligaments bilaterally, the bladder in front and the rectum behind. The incision is vertical a little to either side of the umbilical margin or transverse after Pfannenstiel's method, passing through the superficial field of the cutaneous, fascial, aponeurotic, muscular and peritoneal layers, exposing the deep field comprising the pelvic cavity and its contents after walling back the intestines in all directions. The uterus is recognized first and then adhesions before and behind are broken down. The broad ligaments are traced

<sup>1</sup> Tr. Am. Gynec. Soc., 1909, xxxiv, 536.

<sup>2</sup> Die transversale fundale Keilexcision des Uterus nebst einigen Bemerkungen zur konservativen Chirurgie der Adnexe, Stuttgart, 1911; also Tr. Internat. Cong. Med., London, 1913 (1914), Sec. VIII, Obst. and Gynec., ii, 131.

<sup>3</sup> Loc. cit., p. 441, giving the name wrongly as Bruettner.



bilaterally and their adhesions entirely freed, leaving the uterus and its diseased annexa under control. If both tubes and ovaries are to be sacrificed, the ovarian arteries are doubly tied at the pelvic brim, just beyond the infundibulum. Less advisable than two ligatures are two clamps which subsequent tying of the vessels proximal to the clamps. The division of the broad ligaments is carried toward the uterus between the ligatures or clamps tying vessels as encountered up to the round ligaments which are doubly ligated and divided. The opposite broad ligament is next managed in exactly the same method. Usually at this point with the scalpel the peritoneum on the anterior surface of the womb is divided down to the muscularis from round ligament to round ligament and the peritoneum of the posterior surface is likewise cut through. With blunt dissection both peritoneal flaps are dissected free of the uterus as far as the vagina in front and the rectum and vagina behind, thus freeing the bladder and the bowel from the field of work. The uterine arteries are sought in the bases of these flaps and doubly ligated close to the cervix, thus sparing the ureter, which lies laterally beyond the point of passing the carriers. The vaginal, cervical and uterine stems of the artery must be collectively or separately secured. The artery may be dissected from its bed beyond and behind the ureter and tied at the main trunk, if desired. The uterus and both appendages are now free in the pelvis except for the vaginal implantation. This passage is opened below the cervix after gauze protection of the pelvic field and the wall divided completely on the finger to guard the bladder and the rectum. Spurting vessels are individually secured and after removal of the loose packing in the vagina from below by the nurse, the walls are sutured completely to bring raw surfaces and not mucosa together. The peritoneal edges of the stumps of the broad ligaments and the anterior and posterior peritoneal flaps are sutured directly across the pelvic floor from side to side, leaving no raw points and infolding to fill small cavities. The toilet of the peritoneum is thorough to remove free blood, clots or exudate. No drains are used and a layer suture closes the abdomen. A careful dressing with liberal firm strapping covered in with pads and binder finishes the operation. A piece of gauze may be lightly placed in the vagina and left for twelve to twenty-four hours.

If the ovary and tube are to remain on one or both sides all the steps are the same except that the incision through the broad ligament begins at the cornu uteri and passes vertically along each side of the corpus through the tube and round ligament. The anterior and posterior flaps of peritoneum are then made and the remainder of the operation is as previously described. These steps may all be taken between double ligatures or double clamps according to choice.

*Aftertreatment and cure* are given under subtotal hysterectomy below.

*Subtotal Hysterectomy.*—At least one ovary should be normal and the woman young in the selection of case so that ovulation and menstruation are of paramount importance. Thus one or both annexa as

wholes may be normal but the uterus alone the seat of profound gonococcal metritis. In the technic all details described for total hysterectomy are duplicated down to the separations about the uterus and both annexa. In the proper case such adhesions are relatively much less manifest than in total hysterectomy. The tubes and ovaries are carefully inspected and even if only one ovary is macroscopically normal it is left and all the other annexa removed. Its own tube, if normal, may be spared but being useless had best be sacrificed. The uterus is elevated and a wedge-shaped piece with its base at the fundus and its apex not quite reaching the cervix is removed. Effort to exclude the round ligaments is made and in deepening the incision toward the cervix the broad ligaments may be entered. After this segment of the corpus is ablated hemorrhage is arrested with clamp and ligature or stitch. The incision in the uterus may embrace one tube alone or both tubes and one ovary with one or both tubes, as the object is to spare one ovary for ovulation and the lower segment for the uterus for menstruation.

*Aftertreatment.*—The measures are the same for both classes of hysterectomy. The patient is put to bed and according to indications stimulation, elimination and sedation are applied in the immediate aftertreatment. The Fowler position is the best means of drainage. The vaginal gauze is removed in twenty-four hours and the suture line is inspected on the fifth or sixth day. The stitches are removed on the seventh or the ninth day. Favorable cases are up and about in about two weeks.

The question of drainage must be determined by indications, route and material. All drains are omitted unless particularly necessary. "When in doubt do not drain" is the new dictum, reversing the old contrary one. Abscess cavities not removed, lymph accumulations, obvious possible sources of infection, and damaged and repaired viscera such as the bladder, bowel or rectum are the indications. The vagina is the best route, and the material may be rubber tubing in extreme cases but cigarette drains in average cases, both being combined with light gauze packing of the vagina. Removal of the drain occurs on the fifth or sixth day if not adherent in the deep field, otherwise delay is had for it to loosen. No renewals are advisable except perhaps the light vaginal gauze. Douches are omitted or used with caution against flooding the pelvis through the drainage canals after breaking adhesions by excess of pressure. Vaginal cleansing by the douche is alone necessary, which may be secured by the Fowler position in most cases without any drainage immediately after the operation and without douches later.

The remote aftertreatment is concerned with restoration of the bodily health, strength and function and with attention to sequels of the gonococcus in the externalia.

*Cure.*—Removal of the uterus and appendages of course ablates all disease so far as these organs are concerned so that symptomatic



cure may be absolute unless other signs of the disease persist in and about the vagina, vulva and urethra. Pathologic cure is impossible because the affected organs are totally sacrificed and lost to the physiology of the body.

The bacteriologic cure means removal of the gonococci in any part whatever of the sexual system, which includes the external organs after the internal organs have been removed.

### GONOCOCCAL INFECTION OF THE TUBES AND OVARIES.

**Synonyms.**—Pelvic inflammation, salpingitis, oöphoritis, salpingoöphoritis and annexal disease are commonly used.

**Definition.**—Invasion of the tubes, ovaries and pelvic peritoneum, individually or collectively, by the gonococcus alone or allied. Almost invariably the order of involvement is that of the tubes first and the peritoneum last.

**Type.**—Gonococcal invasion of these organs is an acute infection, almost invariably followed by chronic lesions. The contamination is by direct continuity and contiguity in most cases and very rarely hematogenous along with endocarditis and other signs of systemic complications.

**Varieties.**—The usual classification may be made, so that there are recognized, as to origin gonococcal, nongonococcal and associated infections; as to course acute, subacute and chronic and as to sequels complicated and uncomplicated. In the causal relation the gonococcus predominates and authorities vary in the percentage between about 20 per cent. and about 70 per cent. The later authors with better methods of investigation tend toward the higher proportions, as do those in whose hands all the elements are controlled in each case. Gurd<sup>1</sup> has found that the gonococci are more common in the scrapings of the abscess wall than in the free pus. It is in the latter that most authorities have searched for the organisms, and often in vain.

As heretofore in this work the gonococcal is taken as the type. Nongonococcal lesions occur in the soil made favorable by the gonococcus or their organisms may accompany it at the outset, causing mixed or associated infections.

**Etiology.**—The infection occurs by the gonococcus, which travels in continuity of surface of the mucosa and in contiguity of organs such as tube, ovary and peritoneum as a rule but as an exception through the lymphatic and bloodstream. Primary cases are unknown although it is assumed that salpingitis may arise from the action of toxins. Secondary types are virtually the only ones and nearly all are due to extension and only the occasional example to hematogenous factors. Unilateral cases are rare, in the sense that one tube may entirely escape while its fellow is severely compromised. Bilateral disease is the rule, although

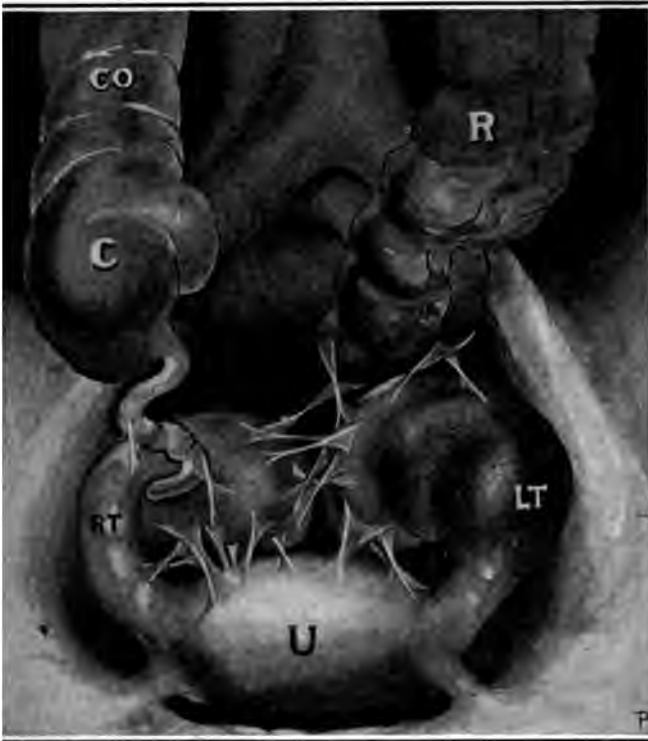
<sup>1</sup> Jour. Med. Research, 1910, xxiii; new series, xviii, 151-175.

one tube may be severely damaged and even destroyed while its fellow comparatively escapes but is nevertheless involved. The predisposing causes are the same as those in any other disease, catarrhal diathesis, ill health, poor habits especially as to alcohol and sexual life, exposure and depreciating occupation. The exciting elements are the gonococcus without or with its allies, stimulated to extension by its own virulence, the patient's low resistance or by faulty management and overactive treatment. Violent examinations, vigorous instrumentations, concentrated applications and ill-advised operations—all chiefly concerned with endocervicitis and endometritis—are extremely important factors in leading to disease in the appendages.

**Pathology.**—The gonococcus as in every other organ invades and locates at first on the surface of the tube and later by penetration reaches the muscularis and peritoneum. In the ovary and in the peritoneum adjoining it and the uterus its performance is much the same, at first superficial, then deep. The essence of the process through the extending and penetrating organisms is at first catarrhal in the early stage of invasion, promptly suppurative in the establishment and in the decline again catarrhal unless there are complications and sequels. The tissues involved are in accordance with these steps in the tubes, at first the epithelial and subepithelial layers of the mucosa and glands and then the muscular and peritoneal coats; and in the ovaries the surface epithelium is at once attacked and denuded, adhesions to adjoining serosa begin and later penetration and denser fixation lead to abscess upon and within the organ; and in the peritoneum the same process is followed until wide extent and great depth are reached with pocket or pockets of pus and flimsy or fibrinous bands. The ovarian lesion is therefore a periovaritis in the majority of cases. True abscess of the parenchyma of the ovary is rare. These facts have an important bearing on the treatment and are the basis of conservative surgery of the ovary.

The temporary lesions are much the same in all three organs. Exfoliation, desquamation, mucus, mucopus and pus during the early exudative invasion and establishment, followed by small round-cell infiltration and finally by decline and healing. Total absorption of exudate is in the mild cases rare and the flimsy adhesions may disappear, leaving little or no changes. The rule, is, however, for permanent lesions through penetration and destruction. In the tubes the exfoliation and small round-cell infiltration lead to superficial or deep ulceration, cellular substitution, scar formation and deformity of the caliber. On its surface duplicate lesions produce adhesions. The ovaries and peritoneum pass through the same experience and usually show few or many dense adhesions which do not absorb and which in any lawless manner may bind the elements of one appendage to themselves, to the uterus, to its fellow and to the surrounding serosa. The entire pelvic contents may be involved in these adhesions. The associated lesions are the antecedent foci from which the extension proceeded, which are almost

ly gonococcal endocervicitis and endometritis with infection in the sexual canal. The complicating lesions are systemic by absorption and bacteremia and direct involvement of any organs. This scientific view makes all the other gonococcal of the sexual system one disease by the process of traveling from point, and not as complications of any initial major lesion, as is in the male. The bacterial lesions are the gonococci, in pure or mixed with their allies, the usual pyogenic germs. The



7.—Right and left pyosalpinx. Adhesions to uterus, rectum and vermiform Co, colon; C, cecum; R, rectum; Rt, right Fallopian tube; Lt, left Fallopian uterus. (Dudley.<sup>1</sup>)

of abscesses is often sterile of the gonococcus and, as just stated, observers have found that the tissue of the abscess wall does contain when the pus is sterile. The gonococcus prepares the soil for invasion of other organisms even after it has seemingly disappeared. As in urethritis its common associates are the gonococcus pyogenes, the *Staphylococcus pyogenes* and the *Bacillus*

<sup>1</sup> Loc. cit.

coli communis. The Bacillus tuberculosis is rare but very important in its secondary relations to the gonococcus in the sexual organs.

**Symptoms.**—Subjective and objective forms, local and general manifestations all varying according to the stages of invasion, establishment and termination are recognized.

The general type is determined by the local and general resistance, the virulence of infection, the progress from point to point, and the condition of freedom, patency and oozing of the tube as contrasted with fixation, closure and retention. The length of antecedent gonococcal infection is an important factor; as a rule the more recent this is the more rapid the onset and the more violent the course of the pelvic complications. There are no pathognomonic symptoms of tubal, ovarian and peritoneal lesions apart from each other. The acute and chronic classification is the best.

*Gonococcal Acute Infection of the Tubes and Ovaries.*—The usual stages of invasion, establishment and termination are of great importance. The invasion may be sudden and sharp or more commonly slow and indefinite. It is often related with menses, childbirth, miscarriage and faulty office treatment for leucorrhea, dysmenorrhea, sterility or suspected gonococcal disease. Fresh relapse of gonococcal foci lower in the sexual organs is an important element, especially endometritis. In the local signs, there is often decrease or cessation of uterine discharge in the earliest hours of the disease exactly as in the male a urethritis temporarily improves during the onset of testicular or prostatic complications. The bladder and rectum are disturbed by the direct irritation of proximate inflammation and by reflex stimulation or inhibition. There may therefore be frequency and pain in both organs or delayed activity. The constitutional signs of pus and infection vary with the intensity of the process. Various related are chilliness or chill, malaise or prostration, fever from nearly normal to about 103° F. with moderate variations, acceleration of pulse, moderate or severe sweating, anorexia, nausea or vomiting, diarrhea or constipation. Rest in bed is welcome and the blood count shows leukocytosis.

In the establishment the condition is determined by the freedom, patency and drainage of the tube so that it oozes pus intermittently upon the peritoneal surface or into the uterus or by the fixation, closure and retention of the tube so that the pus accumulates and distends the tube. The former is a condition of extension and relapses and the latter rather one of protection. Unilateral and bilateral diseases also determine the severity.

The symptoms are subjective and objective, local and systemic. In the local subjective symptoms are found sensory, vaginal, functional, vesical and rectal elements. The sensory signs are more severe than those of metritis, located rather diffusely than centrally over the womb, constant like those of any other abscess or pus-formation, often throbbing with little remission, increased by exertion, constipation, physical examination and intercourse (should the latter in folly be attempted)

l finally decreased by rest in bed and careful regulation of defecation l urination. The vaginal signs continue those of the antecedent iococcal lesions of vagina, cervix and uterus. After the first few iers of decrease the discharge is resumed and often augmented, king the condition duplicate that of gonococcal acute vaginitis and lometritis. Functional disorders are increased, decreased or abol- ed menses according to the ovarian lesion and reaction thereto. ie tendency is toward irregular menorrhagia and even metror- igia.

The vesical signs arise from pressure of the enlarged and displaced rus and the traction of adhesions to the uterus and its appendages and m circulatory and nervous excitement or depression. The latter are n in the very early periods, if at all, while the former occur in the bsequent course. There are therefore frequency, dysuria and tenes- is or retention followed by dysuria and tenesmus. Normal urine oves an uninfected bladder. The rectal elements have the same tors in constipation, tympanites and pain. Congestion, nervous turbance and pressure of the heavy and adherent uterus interfere th normal evacuation, which in turn causes gaseous indigestion and mpanites. All the factors are concerned in the pain. All these mptoms may also be due to the peritonitis without reference to the chanical conditions.

The systemic subjective symptoms continue those of the invasion d are highly various in type according to the severity and progress the disease. In mild cases they may be nearly absent and in intense es they may simulate general peritonitis and septicemia. The ddle ground of these extremes is occupied by a wide assortment of ses.

The objective symptoms are also local and systemic and chiefly mroborate the subjective syndrome. In the local signs bimanual, aginal and rectal examination are painful and dangerous lest pockets f pus be ruptured. A small speculum should be used, if any at all. lbe antecedent gonococcal lesions must be demonstrated in the rethra, vulva, vagina and uterus with foresight as to stimulating xtensions. The uterus must first be recognized as the landmark. It is nlarged, soft, tender and more or less fixed. Traction or pressure way from the point of fixation toward restoration to its normal osition is very painful. Any form or degree of displacement may be resent above the level of the pelvic floor. The cervix is soft, patent nd discharges pus into the speculum and upon the finger.

In the vagina one or both lateral fornices are tender and boggy and be posterior fornix may be filled with an indefinite or definite tumor aying in size from barely perceptible thickening to a mass of lemon r cocoanut size reaching above the pelvic brim. In the acute period rtlines are difficult and persistence of manipulation is very dangerous. is, therefore, sufficient to recognize the fact of involvement rather an its precise pathogenesis.

In the termination only the mild cases subside leaving few symptoms behind, chiefly of functional character with sterility foremost. The majority of cases through the delicacy and complexity of the tissues and organs involved pass at once into the chronic stage. Of these many have a protracted course, profound complications, severe sequels and few escape without virtual unsexing and chronic invalidism.

*Gonococcal Chronic Infection of the Tubes and Ovaries.*—The majority of acute attacks become chronic through the nature of the disease and the anatomy of the parts. The usual classes of subjective and objective, local and systemic symptoms are recognized but the three periods of invasion, establishment and termination cannot be outlined because the invasion consists in the acute attack and the disease is seen in full establishment for a few weeks or even many months.

The general type depends on the activity of the acute antecedent and on the sequels it has produced. Unilateral and bilateral disease are factors, likewise the tubal, tuboövarian and peritoneal forms. The forerunning uterine lesion likewise changes the picture. Cases are seen whose symptoms are more or less stationary without much progress, but others which slowly progress with relapses and exacerbations produced by motion, accident, intercourse, examination, treatment, spontaneous rupture of the tube, secondary infection often of the hematogenous type, or by menses, childbirth and miscarriage.

The local subjective symptoms are sensory, functional, intestinal, urinary and peritoneal. The sensory signs are due to pressure, adhesions, menses and backache. The pressure of the enlarged, displaced and adherent womb on surrounding organs and its tug on the adhesions account for much of the pain. Dysmenorrhea of the chronic congestion, endometritis and malposition are often almost unbearable. The backache arises from all three factors. The functional disorders are exudative, menstrual, sexual and reproductive. Leucorrhea from the endometritis and vaginitis and at times from a leaking tube may be most inconvenient. The congestion of the infection and fixation of the womb excite menorrhagia, metrorrhagia and dysmenorrhea and the same factors combined with decrease in the size of the vagina produce dyspareunia. Sterility is invariable in all marked cases. Such women have one child and no more or none at all in accordance with the period of wedlock in which they acquire gonococcal disease.

The intestinal signs are pain, constipation, indigestion and appendicitis. The pain is due to adhesions to the rectum or to the pressure and pull of the feces on the conglomerate mass within the pelvis. Constipation may be partly voluntary through fear of the pain but is chiefly reflexed. Pressure of the pelvic mass upon the rectum causes constipation, often of marked degree. The various factors lead to gas accumulation, indigestion and the appendix through direct involvement may give rise to appendicitis. The urinary symptoms are often those of cystitis—dysuria, hematuria, tenesmus and reflex retention—more marked when the infection is extensive. Cystitis is ruled out by recog-

izing that the urine is normal. Cystoscopy, if performed, requires most careful antiseptic toilet of the bladder immediately afterward.

The peritoneal syndrome is one of relapsing pelvic inflammation, frequent and moderate rather than rare and severe. This is called "prostitute's colic" and is due to small fresh foci of infection or to the dragging of adhesions. The latter gives this class of patient almost constant bearing down and frequent sharp pain. Materially lowered health is the outcome. While these symptoms are technically peritoneal, the tubes, ovaries and serosa are all combined in their production.

The systemic subjective symptoms are thermic and hemic and may be negative except during exacerbation. The fever is slight or absent while the process is at a standstill but is manifested in any progress of it. The blood count is negative for pus unless a new extension is incident. The pulse in rate and quality follows the same rule. Absorption of the toxic products and the persistent drain of the other symptoms lead to anemia, prostration, depreciation, loss of weight, muscular and nervous stability.

The objective symptoms are also local and systemic, of which the latter verify those described by the patient. The physical examination embraces the external and internal genitals, and in the former prove the gonococcal infection. The uterus is the landmark of the internal organs and shows in addition to the enlargement, tenderness and softening of the chronic endometritis and metritis, fixed malposition and decreased mobility. Attempt to replace the organ or to move it away from the point of maximum fixation excites pain. In the vagina on bimanual examination one or all of the fornices are found invaded, most commonly the posterior with the right or left or both, and less frequently the anterior also. The mass is directly or laterally behind the uterus, of variable and indefinite form, commonly of extensive size and in consistency tense, fluctuating or boggy according to the quantity and quality of the contents and the character of surrounding adhesions. The mass is usually sensitive through embodiment of the ovary and tugging on the adhesions. The size may be too small for definite diagnosis without an anesthetic. The rule is moderate enlargement but extreme cases filling the pelvis are not uncommon. Sole tubal disease is rare as the ovaries are usually compromised. In fact, fixed and immobile ovary may be regarded as significant. Unilateral conditions are also uncommon. The more recent the case the more apt it is to be unilateral and the greater the caution during examination. Older cases especially with relapses are almost always bilateral.

*Gonococcal Relapsing Infection of the Tubes and Ovaries.*—The factors responsible are chiefly leakage, traumatism and new infection. The oozing may take place upon the peritoneal surface or into the uterus, causing "salpingitis profluens," but this condition is more common in serous or catarrhal lesions which have few or practically no adhesions. The trauma may occur during examinations, treatments, accidents, physical exertion and coitus. Objective diagnosis and treatment rest



with the physician and promiscuous investigation of lesions and applications are to be avoided. Mishaps are beyond control but muscular strain and coitus belong to the patient's own care of herself. New infections are those with the gonococcus such as are common in prostitutes or with mixed organisms through the bloodstream and lymph-stream. The *Bacillus coli* is the most common in these circumstances and may reach the sac also through adhesions directly to the rectum.

The acute, chronic or relapsing forms of infection of the tubes and ovaries are rarely fatal directly if the gonococcus is the only organism. The cases are mild, moderate or severe. The mild cases are the rarest and resorb the exudate partially or totally, leaving behind displacements, functional disorder, sterility and fair health. This outcome is apt to appear in patients infected at or near the menopause. Hydrosalpinx with sterile contents may belong to this class of cases, although on histologic grounds this has been disputed by Menge<sup>1</sup> and others, who claim that a pyogenic process cannot retrograde into the condition of hydrosalpinx. The moderate cases may be called the stationary forms and have chronic invalidism, pain, anemia, intestinal disorder, myasthenia, neurasthenia, functional disorder and sterility. The severe lesions may be called the progressing and relapsing cases, having even extragenital and systemic involvements. The tubes may rupture spontaneously into the peritoneal cavity, bowel, bladder, broad ligament or uterus. Upon the serosa the pus repeats all the former picture and threatens a general peritonitis and septicemia. In the bowel the pus causes proctitis, at first acute, then chronic, from the persistent or intermittent evacuation. A sinus ensues which is kept active by pus from the tube and by the feces from the rectum. Mixed infection always occurs ascending from the rectum. The same sequels of event may occur with reference to the bladder. In the broad ligament the pus travels downward in the cellular planes and presents at the vagina or upward along the round ligament and points at the inguinal region. In the uterus the pus causes intermittent and copious leucorrhea in which it is itself the chief constituent.

**Diagnosis.**—Includes the fact of gonococcal involvement and the kind of tubal and ovarian disease and the various other lesions through which confusion may arise. The usual four elements of history, symptoms, laboratory investigations and treatment apply.

Among the most important is the factor of history. The age is usually early in sexual development and the civil condition either married to a man known to be or known to have been a roué. The woman may be of loose morals, admitted or suspected. Underpaid occupation leads young women into temptation. Among the symptoms are those of the antecedent acute urethritis, vaginitis, endometritis, leucorrhea, dysmenorrhea and the like arising soon after such a marriage, or after loose sexual relations. Correlated with the symptoms of

<sup>1</sup> Centralbl. f. Gynäkol., 1895, xix, 796-801.

bal extension is a menstrual period, a childbed fever, miscarriage or new infection after intercourse. Previous good bodily and sexual health followed by the syndrome of external gonococcal disease and by the invalidism with which the woman presents herself is important. Menstrual activities, normal at first, later irregular and painful in flow with pus and a tumor are the next step. Sterility following one childbirth or without conception is of grave meaning, especially if the woman has never had menstrual or sexual disorder. The subjective story of the invasion with its active sickness and the establishment with a systemic reaction and the local manifestation of pus formation in the sensory, vaginal, functional, vesical and rectal signs. The objective examination through the vagina and rectum explores and identifies uterus, tubes, ovaries and pelvis and establishes antecedent foci in the per sexual tract. The laboratory examination will show the blood count of pus in the acute stage and any fresh outbreak of the chronic stage. The gonococcal complement fixation test is positive in most long-standing cases. The gonococci will be found in smear and culture in any postoperative specimen. In the treatment all the expectant methods known to avail during gonococcal disease are an indirect one. Often specimens secured during treatments are most valuable. Laparotomy alone will furnish the exact anatomical diagnosis.

#### COMPARATIVE SYNDROME OF SALPINGITIS (DUDLEY<sup>1</sup>).

##### CATARRHAL SALPINGITIS.

1. Fever present in acute stage and usually absent in chronic stage.

2. Pain in region of tube variable in the acute stage; usually absent or almost absent in chronic stage.

3. Salpingitis profluens not uncommon.

##### PURULENT SALPINGITIS.

1. Fever high in acute stage. Usually slight evening temperature in chronic stage. If pus becomes sterile, temperature may be normal.

2. Pain and systemic disturbance (anxious facies, nausea, depression) more pronounced in acute stage. Pain and general malnutrition usually present in chronic stage. Symptoms partly due to extension of infection to neighboring organs, producing ovaritis, pelvic peritonitis and cellulitis.

3. Salpingitis profluens uncommon.

**Differential Diagnosis.** — Gonococcal tubal infection must be distinguished from other forms and likewise other pelvic lesions giving similar symptoms. The chief other forms are catarrhal, suppurative and tuberculous and the table on page 586 shows the most important differences. In general suppurative pelvic infection secondary to itself the lower genital tract is practically indistinguishable from the gonococcal form except in the laboratory investigation, in its much more frequent relation with miscarriage and childbirth and in its more violent course, shorter duration and tendency to rapidly serious outcome.

<sup>1</sup> Loc. cit., p. 262.

## FORMS OF TUBAL AND OVARIAN DISEASE.

Symptoms.	Gonococcal.	Catarrhal.	Tuberculous.
Age.	Sexual maturity as a rule.	Early or any.	Early or any.
Civil condition.	Wedlock or prostitution.	Children and virgins.	Children and virgins.
Systemic disturbance (nausea, depression, anxiety).	During acute stage.	None or very slight.	Progressing with the disease.
Invalidism (malnutrition and suffering).	During chronic stage.	None.	Progressing with the disease.
Pain.	Severe during acute, constant or relapsing during chronic stage.	During acute stage, absent in chronic period.	Severe and constant sometimes with rubbing sensations and sounds.
Salpingitis profluens.	Occasional and purulent.	Frequent and serious.	Absent through atresia.
Weakness.	Moderate in acute, marked in chronic cases.	Very moderate or absent.	Progressive and rapid.
Fever.	Active low range during acute, moderate and variable during chronic stage, absent during sterile pus in tube.	Moderate during acute, absent during chronic periods.	Afternoon hectic in type.
Pyosalpinx.	Moderate or marked.	None.	Moderate and late after atresia.
Pelvic cellulitis.	Moderate.	None.	Marked.
Spleen.	Not affected.	Not affected.	Enlarged.
Other abdominal viscera.	Not affected.	Not affected.	Often tuberculous.
Rubbing sounds and free fluid.	Absent.	Absent.	Sometimes present.
Other lesions.	Gonococcal in lower sexual tract.	Catarrhal in lower sexual tract.	Tuberculosis in lungs, etc.
Organisms in exudates.	Gonococci.	Micrococcus catarrhalis.	Bacillus tuberculosis (occasionally).
Coitus as source.	Usual.	Rare.	Rare.

Dudley<sup>1</sup> gives the following table of distinction between sactosalpinx and other inflammatory and noninflammatory pelvic disease. Inasmuch as gonococcal infection occasionally follows the type of sactosalpinx the comparisons are worth while here.

## SACTOSALPINX.

Septic condition and pain.  
Commonly bilateral.  
Tube oblong and tortuous.  
Commonly adherent.  
Ovary often palpated and distinguished.  
Usually not larger than fist.  
Leukocytosis usual.

## SACTOSALPINX.

Common.  
Usually bilateral.  
Sensitive to pressure.  
Usually fixed.  
Elastic or fluctuating.  
Result of infection.

## CYSTIC OVARIAN TUMOR.

Absent.  
Commonly unilateral.  
Spheroidal or spherical.  
Less commonly adherent.  
Tumor is diseased ovary.  
May grow to enormous size.  
No leukocytosis unless infected.

## SOLID TUMOR OF TUBE.

Rare.  
Usually unilateral.  
Not sensitive.  
Usually free and mobile.  
Firm consistence.  
Cause unknown.

<sup>1</sup> Principles and Practice in Gynecology, 6th Ed., 1913, p. 265.

## SACTOSALPINK.

Usually sharply circumscribed and of rounded contour.

Commonly bilateral.

Elastic and fluctuating. Not a reliable sign.

Position relative to uterus: mass usually higher in pelvis near fundus uteri; not connected with cervix. Vaginal vault not depressed.

## SACTOSALPINK.

Mass usually elastic; may fluctuate.

Adhesions common.

Sensitive to pressure.

Uterine end of tube enlarged.

History of infection.

## PELVIC CELLULITIS.

Not sharply circumscribed; may be flattened.

Commonly unilateral.

Less elastic and fluctuating. Not reliable.

Position relative to uterus: usually lower in pelvis, often closely connected with uterus. Vaginal vault commonly depressed.

## TUBAL PREGNANCY.

Consistence often quite firm.

Less common.

Not sensitive.

Commonly normal except interstitial tubal pregnancy.

History of pregnancy:

- (a) Amenorrhea.
- (b) Increase in size of uterus.
- (c) Enlargement of breasts.
- (d) Morning sickness.
- (e) Rupture of tube with great pain, collapse (pelvic hematocele), uterine hemorrhage and discharge of decidual membrane.

## SACTOSALPINK (RIGHT SIDE)

Tumor felt by vaginal touch.

After acute stage, size of tumor may not materially diminish.

Recurrence less dangerous and less frequent.

Gastro-intestinal disturbances somewhat marked.

## APPENDICITIS.

Tumor not usually within reach of vaginal touch but is felt or is tender to pressure, on external palpation in region of McBurney's point.

After acute stage, tumor apt to disappear.

Recurrence more dangerous and more frequent.

Decidedly marked.

Other lesions with one or two elements resembling tubal and ovarian disease are uterine malpositions, fecal accumulations, adherent intestine, intestinal tumors, visceroptosis and skeletal tumors. The points for memory in these lesions follow. The sound used cautiously will prove any uterine displacement. Fecal impaction is revealed by digital examination, colonic palpation above the pelvis, the proctoscope, enema and catharsis. Intestinal adhesions and kinks are demonstrated by the bismuth test and the x-ray, the proctoscope and uterine exploration. Intestinal neoplasms have the same positive proof. Enteroptosis varies with changes in the attitude of the patient, mobility of the tumor, functional disturbances of the organ involved, the bismuth meal and the x-ray for gastro-intestinal descent, pyelography and the shadow catheters for the kidneys. Skeletal tumors have bony hardness and fixation through vagina and rectum and essential x-ray findings.

**Treatment.**—All details are determined by acuteness, chronicity and complications. Uncomplicated cases are rare and require the same general treatment with less frequency of major operation. It is understood, therefore, that the average complicated picture is the one referred to in the following paragraphs.

*Gonococcal Acute Infection of the Tubes and Ovaries.*—In the strict sense prophylaxis is not possible beyond good management and treatment of all the possible antecedent gonococcal lesions in order to prevent their extensions to other parts and finally to the tubes and ovaries. Abortive measures are in the nature of things impossible.

The reader is referred to Chapter IX on General Principles of Treatment on page 483 for data of management.

In the physical measures the management of Simpson<sup>1</sup> may be classed. It consists in rest in bed, open bowels, skin and kidneys, light diet, water drinking and the application of heat or cold through bags or coils applied to the abdomen and douches given through the vagina. Massage in the early period is forbidden and includes frequent physical examinations, lest trauma be given the pelvic organs and annexa. Even in the later chronic periods the abdomen must not be invaded by a general massage which is advisable for its passive muscular exercise in the body as a whole and is of much benefit. In hydrotherapy heat and cold are available and chosen solely in accordance with comfort and reaction. The tendency is to try cold during the most acute days and heat later, because cold usually soothes the pain while the heat stimulates inactive circulation and deficient absorption. The bags or coils may be laid on the abdomen and if heat is used it may be slowly augmented up to tolerance. This is particularly true in the douches which without force at all times may be begun with low and advance to distinctly high temperature. The quantity must be copious because duration during application counts most. The technic is described under this subject in vaginitis. Sitting and body baths have the usual indications but cannot be employed before the patient may be safely moved. Posture, especially for drainage, has already been described in endometritis and metritis but must usually wait until symptoms begin to subside. The knee-chest position is said to prevent dense adhesions. Lying on the face may do so during the first few days, if tolerated, until the knee-chest position may be employed in the later periods. Alcohol rubs are of value in keeping down fever and controlling sweats.

The medicinal measures are systemic and local. The systemic administration is chiefly of opiates by mouth, needle or suppository for pain, nervousness and fear and for limiting peristalsis in early peritonitis. Gastric sedatives are given for nausea and vomiting. Cathartics should be used sparingly in order not to excite the peritonitis. There must be neither constipation nor diarrhea on account of the straining in each and the tenesmus in the latter. Diuretics and diaphoretics are all of the simple kind and none is better than the drinking of mineral or plain water. Supportives of the circulation and nervous strength are important. Among the antispasmodics atropine is first and liberally given, as it is a good cardiovascular stimulant and quiets the smooth muscle-fiber of the intestines. The drying aftereffects are controlled by the water drinking. Schindler<sup>2</sup> teaches that the uterus has involuntary

<sup>1</sup> Jour. Am. Med. Assn., 1909, liii, p. 1173-1179.

<sup>2</sup> Arch. f. Gynäkol., 1909, lxxxvii, 607-642.

muscular activity which atropin abolishes and thus extension of the disease is limited. Serumtherapy may be tried, but as in other diseases, so in gonococcal lesions, this method is in its infancy. The serum seems best during the acute periods and the bacterin is the choice during the later stages of the disease. As eliminants colonic instillations after the manner of the Murphy drip or repeated small enemata retained as long as possible are of great value in many patients.

The local administration is chiefly that of douches, as already described under vaginitis. In these douches it is the duration and the heat of the douche rather than the contained drug which are of value. Hence they should be given by a skilled nurse in the most approved fashion.

The surgical measures are nonoperative and operative. The non-operative means are summed up in steps already described on page 564 and in expectant measures involved in waiting for the acute stage to subside.

The operative steps are rare and concerned in symptoms of active absorption due to large accumulations of pus. Such an abscess should be freely opened where safe for the general peritoneal cavity and where drainage will be absolute. The tendency is to leave the wound wide open with due protection against protrusion of the intestines. In general the policy is to delay operation until the disease has become chronic. The reasons are that gonococcal inflammation is more rapidly and more fully self-limited than ordinary pyogenic infection. Adhesions form, walling off the disease from the general peritoneal cavity so that evacuation or other treatment becomes decidedly safer. It is regarded as safe to wait until the patient has begun to improve and has had normal temperature and normal blood count for several weeks. Above all, the period of progressive absorption and depression must be over and no extragenital complications must be in the process of development. The damaging effect of the gonococcus determines the fact that most of these patients finally come to operation.

*Gonococcal Chronic Infection of the Tubes and Ovaries.*—The chief prophylaxis is against reinfection by the husband or lover, because in many of these patients as soon as the subjective symptoms subside sexual activity is resumed. Another preventive measure is to put the patient to bed at the slightest sign of relapse as shown by temperature, blood count, pain or discharge.

Brevity requires reference to Chapter IX on General Principles of Treatment for description of management.

*Curative Treatment.*—After from two to four weeks, with the general condition improved, the fever absent, leukocytosis normal, pulse normal and patient able to move are the factors in the treatment change.

The physical measures may be of very great service. Massage is a means of passive exercise, but it should not be done over the abdomen at all and the masseuse must be skilled and obedient to orders of the physician. The hydrotherapy is the various forms of baths. The sitting bath and the general body bath are both good and if the reaction



to the vigor of the bath and to the massage which is part of it the Turkish bath is excellent. The douches are continued as before but less frequently, while the most important element is concerned in the heat and duration rather than the medication in the fluid.

The medicinal means are systemic and local in their uses. The systemic application is support of the patient during the approach of the chronic period. Hematinics, digestants and laxatives usually fulfil the chief indications. Serumtherapy has already been briefly discussed in the paragraph on the acute lesions. As a rule the bacterins are of greatest value in the chronic period. Local administration is by douche or tampon. The douche is given in the standard manner described under vaginitis, with the same general formulæ and two or three times daily instead of the more frequent interval. Rest in bed should follow such douching when possible. A cleansing douche is advisable before the insertion of a tampon and after its removal so as to cleanse the vagina of discharge from the disease and reaction from the tampon. The tampon should not be too large, must be carefully placed in the fornices surrounding the cervix. The basis of the medication is glycerin with ichthyol, guaiacol and the like in from 10 to 25 per cent. strength. They are left in for about twelve hours or overnight and a dressing worn to receive the vaginal discharge.

The surgical measures are nonoperative and operative.

The nonoperative means are chiefly the various dressings for pains and discharge, catheterization always with great caution for retention of urine and the like. These have been included in previous paragraphs.

*Aftertreatment of Nonoperative Method.*—Gradual restoration of bodily function is the immediate aftertreatment with the aim of having digestion painless, menstruation normal and fecundity possible or probable. In not a small number of these cases well treated, pregnancy and maternity occur. The remote aftercare is watchfulness in every way during pregnancy and puerperium. As a rule the slightest onset of symptoms means a new complication.

*Cure.*—In the pathological sense restoration is not possible through the delicacy and complexity of the parts and the penetrating destructiveness of the organism. Symptomatic cure is, however, not uncommon and the highest degree of it adds physiological restoration so that pregnancy may occur. The absence of gonococci is the bacteriological aim. In general, massive tubes may decrease and soften, tender infected ovaries recover and a fixed congested uterus become more mobile.

The established methods of operative treatment are two: palliative expectant and surgical or operative. Palliation should always be tried carefully as already detailed in the preceding paragraphs and operation must be deferred until expectant means have failed or until special indications arise. It is recognized that in the acute period operation is avoided except in rare instances. The expectant method and nonoperative means are practically identical.

The operative measures are conservative or radical, in which the former aims to remove as little as possible and the latter to ablate the



ns. In the selection of the case and election of the time for operation final judgment is exceedingly difficult and even after due care may frequently be wrong. In general the following factors obtain. Persistent constitutional symptoms marking progress of the disease with fever, pain proceeding from chronic congestion of displacement, adhesion and adhesions and excited by walking, working, urinating, eating or cohabiting, depressed health from absorption, intestinal disturbance, constipation, or the nervous and physical strain, dysmenorrhea and fresh outbreaks of acute suffering are all important factors. In short, the patient must be losing ground and require relief by either conservative operation with preservation of all possible organs or radical operation with the loss of all. Like the expectant or palliative method conservative operations should be attempted. It is easy to remove organs which cannot be replaced and in a certain sense it requires more judgment to know when not to operate than it requires skill to operate. Secondary operations may be done and their radical degree determined by the outcome of the conservative steps.

Other elements in the decision are sexual and social. The sexual factors are age, with its influence on the character and effects of menarche, life, the approach of normal menopause as compared with surgical menopause, the number of children living, the intensity of maternal instinct in unrealized maternity and nervous influences and heredity.

The ovary more markedly than the testicle has a profound influence on the physical economy. It is the essential and distinguishing sex organ. The female is less stable physically and nervously than the male and mental impressions are stronger. Either testis or ovary may be larger than the average and yet not be diseased. The presence of one ovary determines menstruation primarily and in ovulation settles the rhythm of pregnancy. The influence of inflammation on the organ cannot be measured with the naked eye in many cases without obvious abscess. The results of removal of the ovaries are mild, severe or extreme. In mild cases there is little or no disturbance, but in the severer and more advanced cases the disturbances are numerous and common. Extreme cases go on to insanity. The various subjective symptoms are those of forced menopause, the failure of sexuality and untimely sexual old age. The objective signs are hypertrophy of the other ovary where one has been spared and often atrophy of the uterus in marked degree and of the vulva and vagina in less degree when both have been taken away. The muscle substance of the uterus suffers more early and severely, the mucosa. The externalia follow in due time and course.

The social elements are less important. The leisure class may receive relief for symptoms following a conservative operation, whereas the working class must have prompt results and cannot be handicapped by even moderate invalidism.

In the election of time of operation the condition of the lesion and of the functions rules. As to the functions the interval between menstruation is usually the best because there is less nervous disturbance, con-

gestion, bleeding and tendency to infection and absorption. As to the lesion, cessation of active symptoms is essential, notably temperature, blood count and active pus absorption. Finally the question rests on the skill and the knowledge of the operator to judge the pathological condition *in situ* and to foresee the physiological outcome and perceive the needs of the patient.

*Preliminary Curettage.*—After the technic described under the treatment of endometritis on page 564, a curettement of the womb should be done followed by application of an antiseptic, preferably tincture of iodine, as a preliminary to any operation on the tubes and ovaries. Its accepted advantages for abdominal operations are that the iodine sterilizes and stimulates the endometrium after the curette has removed the exuberant diseased mucosa. By attacking the infection in the uterus it removes one of the chief dangers of the pelvic peritoneum when the corpus is amputated from the cervix and for cervical operations limits discharge from above during the period of repair.

*Conservative Surgical Treatment of the Uterus and Annexa.*—Preservation in operation includes the uterus and one tube and ovary usually on the same side. The anatomical order would be this, but the uterus is spared in many operations so that the order of discussion will be tubes, ovaries and uterus.

*Conservative Salpingectomy.*—Operation on the oviduct with as little damage as possible is most important and the subject is only gonococcal infection. In the selection of case (1) one tube may be normal and the other diseased and both ovaries normal. This is the ideal case for conservation of the opposite tube. (2) A more rare condition is sterile hydrosalpinx, occurring after the pus has been absorbed, leaving the serum behind. Such tubes in either class must be reasonably free of adhesions and the contained pus sterile. A difficulty in these cases is that like the endometrium the lining of the uterine attachment of the tube may be the focus of infection and lead to relapses if not removed.

The instruments and supplies are assorted knives, scissors, long forceps, skin and parietal retractors, broad ligament clamps, hemostatic ligature carriers, needles for peritoneum and skin, needle-holder, abundant suture material, adhesive plaster, dressings, binder, etc. The preparation of patient, field, surgeon and every attendant must be any of the approved and accepted methods. The author favors tincture of iodine for the skin of the patient and the Ellice McDonald's method for the hands. The anesthetic is general and preferably ether unless contraindications exist. The posture is dorsal, changed later to the full or exaggerated Trendelenburg. The incision is median in cases of doubt or slightly lateral over the affected side in cases of exact diagnosis. The Pfannenstiel incision is praised by Child<sup>2</sup> and many other writers.

The superficial field contains the skin, fascia, muscle and peritoneum.

<sup>1</sup> Surg., Gynec. and Obst., July, 1914, pp. 82 to 86. Also McMullen: *Ibid.*, July, 1914, pp. 87 to 88; Albany Annals, January, 1917.

<sup>2</sup> Jour. Am. Med. Assn., January 13, 1912, lviii, 91 to 94.



the abdominal wall, layer by layer. Its landmarks are the symphysis pubis below and the umbilicus above. The deep field is the pelvis containing the uterus and annexa and must be fully exposed by walling with pads in all directions. In it the landmark is always the uterus whose adhesions must be gently broken down, followed by those of the detached broad ligament as a whole. Without complete freedom the plastic work will fail. The lateral edge of the broad ligament very close to the tube is tied to catch the offsets from the ovarian artery to the suspensory ligament. Between the ovary and the tube is a group of small vessels which may be individually tied. It is perhaps better to cut the tube free from the upper edge of the broad ligament, tying these vessels as they progress up to the tubal insertion into the uterus. At this point the more vessels secured by a stitch through the muscle substance of the uterus close to the tube. A V-shaped segment of the myometrium is removed with the tube, including its uterine insertion, and the wound is at once repaired.

The foregoing steps include removal of the destroyed tube and the following steps aim to restore as far as possible the anatomical relations within the pelvis. They are strongly recommended by Norris.<sup>1</sup> The broad ligament folded upon itself is sewn to the cornu uteri as a means of support. Then the raw edge of the broad ligament, with all bleeding stopped, is sewn to the round ligament for support of the ovary directly and the uterus indirectly. It is displacement of the ovary downward into the recto-uterine pouch after these operations which is responsible for adhesions, ovarian dysmenorrhea and dyspareunia with other symptoms. Peritoneal covering may be borrowed from the peritoneal reflections of the bladder if desired. In each step leakage of tubal contents is received on gauze and mopped away from the free serous surface. The uterine attachment of the tube may be gently cauterized in its depth before the V-shaped wound is repaired. Careful toilet of every pocket and fold of the deep field and removal of all pads prepare the patient for abdominal suture. In a good case uterus, ovary and broad ligament are in good relation without undue tension which would break down the plastic work. In the dorsal posture, with the wound protected by fresh towels, layer sutures are passed. A firm dressing is applied to the wound and carefully secured with adhesive plaster, extending from loin to loin, beginning above and ending below the dressing, making firm support duly reinforced by a good many tail bandages. The patient is returned to bed with a special nurse and careful observations as to signs of postoperative hemorrhage or infection.

*Aftertreatment.*—The dressings are inspected down to the skin on the fourth or fifth day of uneventful cases and the sutures are removed in about a week. Otherwise each case is a law unto itself in special indications. With primary union the patient is supported in bed about the fourth day and is out of bed about the fourteenth day. The immediate aftertreatment is that just stated, while remote aftercare is comprised

<sup>1</sup> Loc. cit.

in attention to the uterine and other infections from which the disease proceeded, all according to indications.

*Cautions.*—Infection of the general peritoneal cavity is the danger but very rarely occurs in proper selection of case and management of the deep field. Norris, as cited, points out the danger many deep ligatures about the ovarian vessels which may reduce blood supply and cause ovarian malnutrition. Tension on suture has already been discussed, likewise failure to restore ovarian relation. Equally important is failure to support the uterus so that it does not wobble about between bladder and rectum. Raw spots uncover peritoneum lead to adhesions. Neglect of these cautions produces partial or complete failure.

*Radical Salpingectomy.*—For this operation the selection of case implies bilateral tubal and ovarian gonococcal infection, without destructive through complexity of the folds of the mucosa and the nonresistance to the gonococcus. As a rule the uterus must be sacrificed in such cases, because it is otherwise left entirely unsupported and becomes a source of vesical, rectal, digestive, nervous and other symptoms. If the tubes are left the technic is much the same as just described, except that all conservative steps must be omitted. Caution is to remove the uterine implantations of the tubes lest the disease at these points cause relapses which as reported by Norris in his classic work, as cited, and by others, may take the form of abscess or intramural tubal pregnancy.

*Partial Oöphorectomy.*—In leaving part of the ovary behind, selection of case defines focal and not general involvement, which means that the abscess is superficial and localized, leaving the balance of the organ normal. As in the gonococcal tubal disease so in gonococcal ovarian disease the prospects of conservation are relatively poor. The best cases for this form of plastic surgery are the least common—gonococcal infection—single cysts. The technical details through which to duplicate those just described for conservative tubal surgery. The ovary is incised as required, the diseased zones removed and the remainder of the gland carefully sutured so as to coapt the albuginea evenly and fully, without tension, compression, deformation or strangulation of blood supply. All the clinical features are the same as those shown for conservation of the tubes with the following cautions: against infection through the blood clots and defective asepsis; against oöphoritis through rough handling or other traumatism; against adhesions through uncovered surfaces; against prolapse through improper position of the ovary or uterus and their tug on the broad ligament and against cystic changes through poor circulation.

The results are occasionally pregnancy when the remainder of the ovary is healthy and contains the ovulating segment of the follicle. Unfortunately this is the part chiefly sacrificed in resection operations. It is known experimentally that animals will procreate with a small portion of ovary. A temporary difficulty is enlargement and inflammation which subside more or less completely after a few



Both in the inflammation and its subsidence the ovary duplicates the performance of the testis in like circumstances. Prolapse behind the uterus leading to adhesions, congestion and inflammation is another disadvantage resting on loss of normal support of the organ. Secondary operations after attempted conservation are not uncommon, especially in gonococcal cases, and are the chief disadvantage of postponed radical measures.

**Conservative Uterine Surgery.**—The health and function of the uterus are influenced by the ovaries and it becomes practically a useless organ without them and very soon atrophies through suspension of menstrual activity. Removal of both broad ligaments in part along with both tubes and ovaries essentially interferes with the support and position of the uterus which becomes displaced and often adherent and by its physical presence and weight excites vesical and rectal symptoms and by its abnormal condition and traction brings on much pain and invalidism. Moreover the plastic repair of the upper pelvic floor between the rectum and the bladder is much more successful without the uterus than with it. The consensus of opinion is therefore to remove the uterus when both tubes and ovaries must be sacrificed.

**Results and Comments of Conservative Measures.**—*Results.*—Of chief importance is mortality which is certainly lessened to a material degree. The morbidity is likewise decreased by giving a better selection of operation and election of time than if early interference is followed. Cures are regarded as representing about 75 per cent. of the cases, improvements nearly 20 per cent., and failures about 5 per cent., which is as good a record as could be reasonably expected. General health is more or less fully restored in the cures and benefited in the improvements. Menstruation may be ultimately not affected or if disturbed it is chiefly delayed or irregular. Normal pregnancy is always physically possible in the cures although often not probable, but inasmuch as it is without exception mentally expected and hoped for, the courage of the patient remains good. Tubal pregnancy is by no means uncommon. In fact, it is admitted that one of the most potent causes of this abnormality is inflammatory change in the lining and form of the tubes. Revision of operation or secondary interference at a later date is due to incidence of the disease upon the previously normal opposite tube or its progress in a macroscopically apparently normal tube. The percentage of these cases is about 6 per cent. which nearly corresponds with the approximate 5 per cent. of failures just stated.

**Comments.**—A review of the surgery of the uterus and annexa in gonococcal infection is divisible into preliminary treatment, the choice of operation as to successes and failures and the after-treatment.

Judicious preliminary treatment is always worth while. It often avoids operation and always offers improved conditions at the operations and greater independence in the election of time for interference.

In the choice of operation and time of operation decision is made between immediate interference and delayed invasion as to time and conservative and radical measures as to method. Another view-point

is that of the unfavorable and the favorable procedures both in time and technic. The basis of each has already been named in discussing the various methods.

A preliminary curetting must proceed any of the operations.

I. Among the unfavorable decisions are to be named the following:

1. Immediate evacuation of pus except when the patient is doing badly and when the peritoneal cavity is naturally walled off.

2. Plastic repair of gonococcal tubes because the remnants are of little value and often highly pathologic microscopically.

3. Conservation of grossly diseased gonococcal tubes is a mistake because it leaves a potent focus untouched and often causes extension and secondary operation.

4. Radical measures are less favored than conservative.

II. Among the favorable decisions are to be classed the following:

1. Conservation of a normal annexum when its fellow is diseased.

2. Conservation of one or both ovaries if nutrition in the circulation and normal position by plastic repair are obtained. Ovulation and menstruation continue.

3. Conservation of one or both ovaries in hysterectomy. Ovulation continues although menstruation is abolished.

4. Partial oöphorectomy, with restoration of the coats by suture, preservation of circulation by judicious ligature and of ovulation by sparing the follicular zone.

5. Total hysterectomy if both appendages must be sacrificed. Subtotal hysterectomy in youth with a portion of the uterus and ovulation and menstruation essential.

In choice of time of operation the immediate evacuation of pus has already been detailed in the foregoing paragraphs. The period of subsidence of symptoms or the chronic stage is almost always the best for operation.

The aftertreatment, like the preliminary treatment, is very important and provides for control of the minor postoperative ills and the restoration of bodily health and the equalization of sexual function so far as possible.

**Radical Pelvic Surgery.**—This term usually includes removal of all the internal sexual organs in woman. It therefore means sacrifice of the uterus as a whole or down to the vaginal portion of the neck combined with both tubes and ovaries. The majority of operators are apt to leave the stump of the neck to simplify and shorten the procedure. The technic is the same as that given for hysterectomy without or with both appendages under metritis. With proper selection of case and well-balanced preliminary treatment radical methods are less and less common in gonococcal infections.



## CHAPTER XI.

### COMPLICATIONS, SEQUELS AND RARE FORMS OF GONOCOCCAL INFECTION IN THE FEMALE.

#### AGE AS A FACTOR OF IMPORTANCE.

**General Significance.**—In the male the chief and primary lesion is gonococcal urethritis, about which are grouped the minor and major complications as they occur in the urinogenital system and the body at large, respectively constituting the urinogenital and the extra-urinogenital groups. In the female the same rule could be followed, and formerly was adopted by accepting vulvovaginitis, without or with urethritis, as the primary inoculation and all other lesions as complications or sequels thereof. The modern tendency, however, is to regard the sexual mucosa as a whole from vulva to peritoneum, and the invasion by the gonococcus of any part thereof not as a complication but as an involvement in continuity and contiguity in the ordinary progress of the disease, according to severity.

This plan makes uncomplicated gonococcal disease in the female a truly sexual disease and begins to add complications only when the urinary system becomes involved in bladder, ureters and kidneys, and when the whole body is occasionally involved in any of its systems. This view could be and in the author's opinion should be accepted for the male also. It is readily foreseen that ere long this will be the pathogenetic standard and will constitute scientific progress. Inasmuch, however, as the older distinction as to the male is still found in widest acceptance it has been adopted in this work.

The rare forms or manifestations of gonococcal disease may belong to the genital or extragenital groups and the most important include the following: Among the genital lesions are chiefly hydrops tubæ profluens, torsion of gonococcal uterine annexa, associated infections and gonococcal tubal pregnancy.

Among the extragenital lesions are chiefly intraperitoneal rupture of gonococcal foci and gonococcal general peritonitis.

#### I. EXTRAGENITAL OR SYSTEMIC COMPLICATIONS.

**Classification.**—There are in the female, as in the male, two groups, which are the urinary and the systemic.

##### A. URINARY GROUP.

**Clinical Features.**—There is no essential or material difference between the sexes in complications of the urinary organs—bladder, ureters and kidneys.



**Gonococcal Cystitis, Ureteritis and Pyelitis**, in their clinical are in every way the duplicates of those found in the male, reader will note the descriptions thereof in the earlier part of t



FIG. 128.—A, A, the ducts leading from Skene's glands swollen and everted. The black dots represent the openings. (Dudley.)



FIG. 129.—Urethral caruncle on side of the meatus, simulating a swollen and everted duct. Observe the absence of a duct. (Dudley.)



FIG. 130.—Expression of pus from the ducts of Skene's glands. With two fingers within the vagina to support the urethra from slipping to either side a sterilized hair-pin may be passed into the urethra, turned slightly sidewise over the glands and drawn forward, pressing out their individual contents exactly like a comedo. This manipulation will succeed often when simple pressure fails. (Dudley.)



FIG. 131.—A large hypodermic needle with blunt point and small tube attached. This is intended as a means of which may be inserted into Skene's ducts medicinal solution for treatment of infection. (Dudley.)

<sup>1</sup> Principles and Practice of Gynecology, 6th ed., p. 329.

## B. SYSTEMIC GROUP.

**Clinical Relations.**—As in the male, the process of absorption may involve any system of the body in complications, which then are designated in accordance with the system attacked. The relative frequency, importance and results in the female are in no real detail otherwise than in the male.

The reader will find the various complications as they arise in the male fully discussed in the order of systems of the body.

## II. GENITAL OR LOCAL COMPLICATIONS.

**Classification.**—The more usual sexual complications are urethral, pudendal and uterine. The urethral lesion of importance, though not frequent in the woman, is stricture, and those of the pudendum are condylomata acuminata, pruritus vulvæ and vestibular adenitis. Abscess of the uterine muscle is the one true uterine complication.

## STRICTURE OF THE URETHRA.

**Clinical Features.**—This lesion in woman is much less common than in man, through the nature of the urethra, which is the most dilatable part of the canal. It may, however, as in the male, occur at any point of the passage, and is therefore meatal or intraurethral in site. Its form is very commonly annular, but it may have any of the irregularities seen in stricture of the other sex.

**Symptoms.**—The symptoms subjectively duplicate those in man and are chiefly, frequency, urgency, dysuria, pollakiuria and tenesmus. Total obstruction of the canal is rarely seen. The objective symptoms make the diagnosis. Inspection will reveal the deformity if meatal and palpation with the finger or with instruments will detect the nodule in the canal from the vestibule and vagina.

**Treatment.**—Stricture of the female urethra, as in the male, may be dilated or divulsed. The last measure is not advisable. The majority of strictures respond well to gradual dilatation and only a few must be incised. All the preliminary diagnosis and treatment and the after-treatment prescribed for the male in Chapter VII must be followed in the female.

## GONOCOCCAL CONDYLOMATA ACUMINATA.

**Significance.**—Significance establishes that this lesion is a common accompaniment of chronic mixed infection in uncleanly subjects and appears in the folds and apposed surfaces of the external genitals and skin much like verruca in other parts of the body.

**Varieties.**—The varieties are the sessile, having a broad base, and the pedunculated, having a more or less narrowed attachment.

As to situation, gonococcal condylomata acuminata are urethral,

to the vigor of the bath and to the massage which is part of it the Turkish bath is excellent. The douches are continued as before but less frequently, while the most important element is concerned in the heat and duration rather than the medication in the fluid.

The medicinal means are systemic and local in their uses. The systemic application is support of the patient during the approach of the chronic period. Hematinics, digestants and laxatives usually fulfil the chief indications. Serumtherapy has already been briefly discussed in the paragraph on the acute lesions. As a rule the bacterins are of greatest value in the chronic period. Local administration is by douche or tampon. The douche is given in the standard manner described under vaginitis, with the same general formulæ and two or three times daily instead of the more frequent interval. Rest in bed should follow such douching when possible. A cleansing douche is advisable before the insertion of a tampon and after its removal so as to cleanse the vagina of discharge from the disease and reaction from the tampon. The tampon should not be too large, must be carefully placed in the fornices surrounding the cervix. The basis of the medication is glycerin with ichthyol, guaiacol and the like in from 10 to 25 per cent. strength. They are left in for about twelve hours or overnight and a dressing is worn to receive the vaginal discharge.

The surgical measures are nonoperative and operative.

The nonoperative means are chiefly the various dressings for pus and discharge, catheterization always with great caution for retention of urine and the like. These have been included in previous paragraphs.

*Aftertreatment of Nonoperative Method.*—Gradual restoration of bodily function is the immediate aftertreatment with the aim of having digestion painless; menstruation normal and fecundity possible or probable. In not a small number of these cases well treated, pregnancy and maternity occur. The remote aftercare is watchfulness in every way during pregnancy and puerperium. As a rule the slightest onset of symptoms means a new complication.

*Cure.*—In the pathological sense restoration is not possible through the delicacy and complexity of the parts and the penetrating destructiveness of the organism. Symptomatic cure is, however, not uncommon and the highest degree of it adds physiological restoration so that pregnancy may occur. The absence of gonococci is the bacteriologic aim. In general, massive tubes may decrease and soften, tender infected ovaries recover and a fixed congested uterus become more mobile.

The established methods of operative treatment are two: palliative or expectant and surgical or operative. Palliation should always be tried carefully as already detailed in the preceding paragraphs and operation must be deferred until expectant means have failed or until special indications arise. It is recognized that in the acute period operation is avoided except in rare instances. The expectant method and non-operative means are practically identical.

The operative measures are conservative or radical, in which the former aims to remove as little as possible and the latter to ablate the

gans. In the selection of the case and election of the time for operation final judgment is exceedingly difficult and even after due care may be frequently wrong. In general the following factors obtain. Persisting constitutional symptoms marking progress of the disease with lapses, pain proceeding from chronic congestion of displacement, menstruation and adhesions and excited by walking, working, urinating, defecating or cohabiting, depressed health from absorption, intestinal disturbance, constipation, or the nervous and physical strain, dysmenorrhea and fresh outbreaks of acute suffering are all important factors. In short, the patient must be losing ground and require relief by either conservative operation with preservation of all possible organs or radical operation with the loss of all. Like the expectant or palliative method conservative operations should be attempted. It is easy to remove organs which cannot be replaced and in a certain sense it requires more judgment to know when not to operate than it requires skill to operate. Secondary operations may be done and their radical degree determined by the outcome of the conservative steps.

Other elements in the decision are sexual and social. The sexual factors are age, with its influence on the character and effects of menstrual life, the approach of normal menopause as compared with artificial menopause, the number of children living, the intensity of maternal instinct in unrealized maternity and nervous influences and ability.

The ovary more markedly than the testicle has a profound influence on the physical economy. It is the essential and distinguishing sex organ. The female is less stable physically and nervously than the male and mental impressions are stronger. Either testis or ovary may be larger than the average and yet not be diseased. The presence of the ovary determines menstruation primarily and in ovulation settles pregnancy. The influence of inflammation on the organ cannot be measured with the naked eye in many cases without obvious abscess. The results of removal of the ovaries are mild, severe or extreme. In the mild cases there is little or no disturbance, but in the severer and average cases the disturbances are numerous and common. Extreme examples go on to insanity. The various subjective symptoms are those of the forced menopause, the failure of sexuality and untimely sexual old age. The objective signs are hypertrophy of the other ovary where one has been spared and often atrophy of the uterus in marked degree and of the vulva and vagina in less degree when both have been taken away. The muscle substance of the uterus suffers more early and severely, than the mucosa. The externalia follow in due time and course.

The social elements are less important. The leisure class may receive attention for symptoms following a conservative operation, whereas the working class must have prompt results and cannot be handicapped by even moderate invalidism.

In the election of time of operation the condition of the lesion and of its functions rules. As to the functions the interval between menstruations is usually the best because there is less nervous disturbance, con-

gestion, bleeding and tendency to infection and absorption. As to the lesion, cessation of active symptoms is essential, notably temperature, blood count and active pus absorption. Finally the question rests on the skill and the knowledge of the operator to judge the pathological condition *in situ* and to foresee the physiological outcome and perceive the needs of the patient.

*Preliminary Curettage.*—After the technic described under the treatment of endometritis on page 564, a curettement of the womb should be done followed by application of an antiseptic, preferably tincture of iodine, as a preliminary to any operation on the tubes and ovaries. Its accepted advantages for abdominal operations are that the iodine sterilizes and stimulates the endometrium after the curette has removed the exuberant diseased mucosa. By attacking the infection in the uterus it removes one of the chief dangers of the pelvic peritoneum when the corpus is amputated from the cervix and for cervical operations it limits discharge from above during the period of repair.

*Conservative Surgical Treatment of the Uterus and Annexa.*—Preservation in operation includes the uterus and one tube and ovary usually on the same side. The anatomical order would be this, but the uterus is spared in many operations so that the order of discussion will be tubes, ovaries and uterus.

*Conservative Salpingectomy.*—Operation on the oviduct with as little damage as possible is most important and the subject is only gonococcal infection. In the selection of case (1) one tube may be normal and the other diseased and both ovaries normal. This is the ideal case for full conservation of the opposite tube. (2) A more rare condition is a sterile hydrosalpinx, occurring after the pus has been absorbed, leaving the serum behind. Such tubes in either class must be reasonably free of adhesions and the contained pus sterile. A difficulty in these cases is that like the endometrium the lining of the uterine attachment of the tube may be the focus of infection and lead to relapses if not removed.

The instruments and supplies are assorted knives, scissors, long forceps, skin and parietal retractors, broad ligament clamps, hemostats, ligature carriers, needles for peritoneum and skin, needle-holders, abundant suture material, adhesive plaster, dressings, binder, etc. The preparation of patient, field, surgeon and every attendant may be any of the approved and accepted methods. The author favors tincture of iodine for the skin of the patient and the Ellice McDonald<sup>1</sup> method for the hands. The anesthetic is general and preferably ether unless contraindications exist. The posture is dorsal, changed later to the full or exaggerated Trendelenburg. The incision is median in all cases of doubt or slightly lateral over the affected side in cases of exact diagnosis. The Pfannenstiel incision is praised by Child<sup>2</sup> and many other writers.

The superficial field contains the skin, fascia, muscle and peritoneum

<sup>1</sup> Surg., Gynec. and Obst., July, 1914, pp. 82 to 86. Also McMullen: *Ibid.*, July, 1915, pp. 87 to 88; Albany Annals, January, 1917.

<sup>2</sup> Jour. Am. Med. Assn., January 13, 1912, lviii, 91 to 94.



thrombosis in the condylomata by spraying on ethyl chloride. This is a bloodless means of shedding the warts and is recommended also by Norris,<sup>1</sup> who adds that the freezing must be continued for four or five minutes for each growth to secure efficiency.

The surgical measures are nonoperative, as presented in this lesion in the male, and operative. The preparation of the field is rather long treatment for as much freedom from discharge and exudate as possible and dryness of the parts. Only extensive cases require a general anesthetic, whereas cocain solution may be infiltrated around and into the base of smaller warts. The larger growths may be clipped away with the scissors or, better, with the knife rather deeply and widely into the base away from the pedicle. The gaping wounds are stitched with horse-hair, fine catgut or silk. The smaller verruca may be curetted away with the sharp intrauterine curette intersecting the base, as in the author's case of the illustration, Fig. 133. Extensive examples of the disease require several sittings in order to avoid opening many avenues of infection. Mild caustics, such as 10 per cent. silver nitrate, are applied to all raw surfaces for antisepsis and hemostasis. Local applications of caustics, with protection of the annexa, will ablate the smaller outgrowths. The wounds of any method must be dressed on surgical principles.

**Aftertreatment.**—Surgical care of sutured wounds and raw spots is the immediate aftertreatment in order to prevent infection and ulceration, which may be extensive and partake of chancroidal tendency. The remote aftertreatment is a return to the prophylactic principles of cleanliness and dryness to provide against relapse.

**Cure.**—The tendency towards warts is inherent in many skins under very little irritation. These patients will have several more or less troublesome crops until the gonococcal and allied infections of the upper genitals are relieved.

#### GONOCOCCAL PRURITUS VULVÆ.

**Significance.**—Pruritus ani et vulvæ have been proved by Murray<sup>2</sup> to be due to the streptococcus. Undoubtedly the gonococcus is occasionally a factor.

**Clinical Features.**—Etiology, pathology, symptoms and diagnosis are treated of in works on gynecology.

**Treatment.**—The serum method described by Murray, associated with surgical cleanliness and dryness, is the one scientific procedure.

#### GONOCOCCAL VESTIBULAR ADENITIS.

**Synonyms.**—Synonyms, chiefly due to changes in anatomical nomenclature are Bartholin's, vulvovaginal adenitis or vestibular adenitis.

<sup>1</sup> Gonorrhea in Women, 1913, p. 200.

<sup>2</sup> Jour. Am. Med. Assn., December 9, 1911; Tr. Am. Proctologic Soc., 1913, 1914, and 1915.

in attention to the uterine and other infections from which the tubal disease proceeded, all according to indications.

*Cautions.*—Infection of the general peritoneal cavity is the chief danger but very rarely occurs in proper selection of case and management of the deep field. Norris, as cited, points out the danger of too many deep ligatures about the ovarian vessels which may reduce the blood supply and cause ovarian malnutrition. Tension on suture lines has already been discussed, likewise failure to restore ovarian relations. Equally important is failure to support the uterus so that it does not wobble about between bladder and rectum. Raw spots uncovered by peritoneum lead to adhesions. Neglect of these cautions promotes partial or complete failure.

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**Radical Pelvic Surgery.**—This term usually includes removal of all the internal sexual organs in woman. It therefore means sacrifice of the uterus as a whole or down to the vaginal portion of the neck combined with both tubes and ovaries. The majority of operators are apt to leave the stump of the neck to simplify and shorten the procedure. The technic is the same as that given for hysterectomy without or with both appendages under metritis. With proper selection of case and well-balanced preliminary treatment radical methods are less and less common in gonococcal infections.

## CHAPTER XI.

### COMPLICATIONS, SEQUELS AND RARE FORMS OF GONOCOCCAL INFECTION IN THE FEMALE.

#### AGE AS A FACTOR OF IMPORTANCE.

**General Significance.**—In the male the chief and primary lesion is gonococcal urethritis, about which are grouped the minor and major complications as they occur in the urinogenital system and the body at large, respectively constituting the urinogenital and the extra-urinogenital groups. In the female the same rule could be followed, and formerly was adopted by accepting vulvovaginitis, without or with urethritis, as the primary inoculation and all other lesions as complications or sequels thereof. The modern tendency, however, is to regard the sexual mucosa as a whole from vulva to peritoneum, and the invasion by the gonococcus of any part thereof not as a complication but as an involvement in continuity and contiguity in the ordinary progress of the disease, according to severity.

This plan makes uncomplicated gonococcal disease in the female a truly sexual disease and begins to add complications only when the urinary system becomes involved in bladder, ureters and kidneys, and when the whole body is occasionally involved in any of its systems. This view could be and in the author's opinion should be accepted for the male also. It is readily foreseen that ere long this will be the pathogenetic standard and will constitute scientific progress. Inasmuch, however, as the older distinction as to the male is still found in widest acceptance it has been adopted in this work.

The rare forms or manifestations of gonococcal disease may belong to the genital or extragenital groups and the most important include the following: Among the genital lesions are chiefly hydrops tubæ profluens, torsion of gonococcal uterine annexa, associated infections and gonococcal tubal pregnancy.

Among the extragenital lesions are chiefly intraperitoneal rupture of gonococcal foci and gonococcal general peritonitis.

#### I. EXTRAGENITAL OR SYSTEMIC COMPLICATIONS.

**Classification.**—There are in the female, as in the male, two groups, which are the urinary and the systemic.

##### A. URINARY GROUP.

**Clinical Features.**—There is no essential or material difference between the sexes in complications of the urinary organs—bladder, ureters and kidneys.

**Treatment.**—Care of the urethritis, vulvitis and vaginitis are the prophylaxis, but only in the indirect sense. Freedom from clinging pus around the vestibule is of primary importance and douches must not be so strong as to inflame the mucosa and thus cause chemical inflammation of the ducts. Cleanliness of the hands protects the



FIG. 134



FIG. 135

**FIGS. 134 and 135.**—Author's case of fibromyxoma of the labium majus. Gross specimen. Fig. 134 shows the anterior and Fig. 135 the posterior view of the tumor, whose several prolongations were distributed as follows: *A*, prolongation toward the inguinal canal; *B*, main body of the tumor in the labium majus; *C*, prolongation toward the thyreoid foramen; *D*, prolongation toward the rectum.

eyes of the patient and all dressings should be put into paper bags and burned. The abortive measures against this complication are ineffective.

Requisites of management are given in Chapter IX on General Principles of Treatment on page 483.

*Durative Treatment.*—The physical measures are hydrotherapy during the acute stages. Douches are given in the manner described for vaginitis, but with a small rubber catheter whose insertion will use the least pain. Vulvar lavage with the pitcher and douche-pan is convenient in keeping the pudendum clean. Sitting and body baths cannot be used during the acute stage, but they are comforting to the declining period of patients who refuse operation.

The medicinal measures have little direct effect on the lesion except the immediate control of such symptoms as pain. Systemic and local administration are therefore much the same as those in other gonococcal lesions. Wet dressings regularly applied to the vulva reduce the cellulitis accompanying the abscess and limit even the abscess itself. The milder lotions, such as aluminum acetate, 6 per cent., are the best. Serumtherapy may be tried, but in the present state of our knowledge promises little. The serum may be used in the first days and the bacterin in the presence of sinuses and chronic abscess.

*Surgical Treatment.*—The treatment of gonococcal vestibular adenitis is purely surgical and either palliative or radical. The palliative measures consist in aspiration of the cyst followed by injection of a mild, limited caustic such as nitrate of silver, 5 to 10 per cent., a few drops of pure carbolic acid or tincture of iodine and the like. Obliterative inflammation may follow this injection, but the measure usually fails, because the numerous acini of the gland not involved in the cyst escape adhesive closure. The cyst itself may likewise not so respond. Division and drainage of the cyst also fail for the same reasons. The condition is not unlike hydrocele in the male in these peculiarities.

The operative details are the usual preparation of the field and the same as preliminaries. The instruments and supplies consist of a sharp scalpel, curved scissors, hemostats, anatomical and toothed forceps, small sharp and blunt retractors, needles and needle-holder, sutures, ligatures, dressings and a T-bandage. In small cysts the anesthesia is local, but in larger specimens it must be general. The patient is in the lithotomy posture and the general landmark is the labium majus containing the cyst, made tense by pressure from above. The incision is preferred from above downward over the prominence in the modified skin a little in front of the duct of the gland. The superficial field contains the modified skin and underlying erectile tissue, which is separated from the cyst in the deep field by blunt dissection except where bands require division. No buttonholes of the outer or inner skin should occur. With care the entire sac may be removed, but if broken its extensions must be carefully clipped away, otherwise a blind pouch and a relapse will ensue. There is no drainage and the wound is sutured with buried catgut in its depths and interrupted or subcuticular suture closes the margin. Compression with a large dressing prevents the formation of dead spaces. The immediate after-treatment is to keep the dressings clean of urine and feces and to avoid infection by immediate wet dressing at the earliest sign. There is otherwise no special feature in the nursing, diet or medication.

Treatment of suppurative bartholinitis is likewise purely surgical and has no palliative means, as aspiration, injection, incision, cauterization, curettement and drainage all fail. Abortive measures, chiefly as wet dressings promptly and persistently applied, may stop an infected gland from becoming an abscess. The operative means are in every detail the same as those just described for cyst of the gland. The presence of pus makes the blunt dissection more difficult in the acute cases, but the infiltrations and adhesions may be overcome with patience. Chronic abscess is the form most often submitted to intervention and is dealt with in the same way. It is occlusion of the duct in chronic abscess which usually leads to cyst, with which it is surgically identified. On account of the pus present the cavity of the wound should be swabbed with the tincture of iodine and a small drain inserted.

*Aftertreatment.*—Drainage and dressings with care of the urethritis and the vaginitis are the immediate aftertreatment. The drainage must be free and unobstructed and the dressings frequently changed for cleanliness and in protection of the opposite gland. Urine and feces must be carefully removed by lavage with pitcher and douche-pan. All the measures described for the treatment of urethritis and vaginitis must be continued. Remote aftercare is concerned in the treatment of the last two conditions which often persist after the glands have recovered. The opposite gland, if normal, should be kept so by all these measures.

*Cure.*—Removal of a cyst of the vestibular gland cures the cyst in the pathological sense, but not the gland which must be sacrificed. These same truths apply to abscess of the gland. Symptomatic cure, however, is obtained in almost every instance of both lesions and means healing without sinus or relapse and with as little destruction and damage to the labium as possible. Bacteriological cure implies absence of infection in the gland if not the subject of operation, in its fellow and in the antecedent lesions. Hematology must show a negative complement fixation test. Vestibular adenitis, especially if old, may give a positive test.

### GONOCOCCAL INTRAMURAL UTERINE ABSCESS.

**Synonym.**—Intramural uterine phlegmon.

**Significance and Occurrence.**—Deep suppuration and septic process mark the importance of this rare condition.

**Varieties.**—Nongonococcal, due to the ordinary organisms of pus and gonococcal, due to the gonococcus, are seen.

**Pathology.**—Intense endometritis and metritis finally focalize into true abscess.

**Symptoms.**—A severe gonococcal invasion is followed by marked uterine symptoms and then by the septic abscess.

**Diagnosis.**—Full recognition is possible only at operation or pathological examination. A prominent swelling of one portion of the womb is suggestive. Presence of the gonococcus is essential.

**Differential Diagnosis.**—Distinction is necessary between abscess and salpingitis, degenerating myoma and torsion of ovarian tumors, as shown in special works on gynecology.

**Treatment.**—Surgical measures alone avail. If thoroughly walled off by adhesions the abscess may be evacuated, otherwise hysterectomy is necessary.

### III. RARE FORMS OF GONOCOCCAL INFECTION IN THE FEMALE.

**Classification.**—As already stated in previous paragraphs on general significance, the subdivisions are two: genital and extragenital. For our purposes only the more important of the genital group will be considered, such as hydrops tubæ profluens, torsion of gonococcal uterine annexa, hernia of gonococcal annexa, associated infections and gonococcal tubal pregnancy. Likewise only the chief extragenital conditions will be noted, such as rupture of gonococcal foci and gonococcal general peritonitis.

**Clinical Features.**—Founded on the gonococcus as the causative organism, the pathology, symptoms, diagnosis and treatment of all these lesions are the same as those from other causes. Each is fully described in special monographs on diseases of women.

### GONOCOCCAL ASSOCIATED INFECTIONS.

**Definition.**—By this title of gonococcal associated infections is meant chiefly cases in which other organisms attack the parts after the gonococcus has been present. It also means cases in which the gonococcus directly associated with other pyogenic organisms becomes inoculated at practically the same time. It may be applied likewise to those cases in which the gonococcus is not the antecedent but the subsequent invader after the other organisms have had their day.

**Occurrence.**—The condition is not by any means uncommon, and as more careful bacteriological study is done it will undoubtedly be found still more common. Mixed infections in fresh cases with great activity of the gonococcus are rare, but become more frequent with the duration of the gonococcal disease.

**Etiology.**—As shown in the definition the gonococcus is usually the primary organism, alters the local health of the mucous membrane and lessens the resistance so that the other organisms have free action. The pyogenic organisms are the most common associates, particularly the streptococcus, staphylococcus and colon bacillus. The *Bacillus of tuberculosis* is by no means unusual. All the other predisposing and exciting local and systemic causes described under etiology in the male and female apply with added force in these associated invasions.

**Pathology.**—All the various details described under this general subject in the male and in the female are present, adding the effect of the new organisms in their pyogenic role, combining with or following



upon the effects of the gonococcus. If the associated organism is the *Bacillus of tuberculosis* then the particular lesions of this disease are found.

**Symptoms.**—Nothing may be added to the previous pictures drawn for the gonococcal disease itself except in the case of tuberculosis, which must have its typical chronicity and tendency toward dull or active pain and depreciation of health seen in the disease.

**Diagnosis.**—All the other elements shown in gonococcal infection are used. The laboratory presents the best evidence, but if the other organisms occur with the gonococcus they may overgrow it in culture and mask its presence. In some of these cases the gonococcal complement fixation is possible and valuable.

**Treatment, Aftertreatment, Cure** are the same as those already shown for pure gonococcal disease.

### GONOCOCCAL GENERAL PERITONITIS.

**Gonococcal Local Peritonitis.**—This subject is fully included under Tubal and Ovarian Disease and will therefore be otherwise omitted.

**Occurrence.**—Gonococcal infection of the general peritoneal cavity is rare, chiefly because of the plastic tendency of the inflammation to wall off the point of onset and thus limit it chiefly to the pelvis. Its existence is beyond doubt through modern bacteriological researches.

**Etiology.**—After the play of all the predisposing and exciting local and systemic factors described under etiology in general in the male and female, there follows decreased resistance and penetration into the peritoneal cavity. The peculiar exudative and circulatory conditions in menstruation and the puerperium are contributing causes. The gonococcal pus is evacuated upon the peritoneum directly by leakage or rupture of a tube following torsion, pressure or other direct action. A few cases have been determined by infection through the lymphatics and still others by direct continuity of the mucosa, with the serosa at the fimbriated extremity of the tube. Perhaps the smallest number are operative accidents.

**Pathology.**—All the various lesions described in the male under this subject apply. In general, gonococcal peritonitis shows fewer macroscopic lesions than do other purulent forms. The membrane is reddened, coated with comparatively little pus and forms adhesions early.

**Symptoms.**—The syndrome of invasion and establishment noted on page 218 for this complication in males may be applied for woman, and in general are those of any other peritonitis with a tendency toward decreased severity. Its onset is in the pelvis, where the earliest and most intense and usually the most persistent symptoms are found. It differs from peritonitis in the male chiefly in a rather definite record of preliminary tubal disease followed by rupture and infection. The termination is rather more favorable than other forms of peritonitis. With the subsidence of the severe symptoms appear those of adhesions with a long and various line of digestive and other disturbances, as already shown in pelvic peritonitis.

**Diagnosis.**—All the other elements of proof are applied. The history shows early venereal infection of gonococcal type followed by the symptoms of progressing involvement of the internal organs and then by a sudden onset of the peritonitis. The gonococcal complementation test may be of great value. The laboratory must establish the gonococcus in the genitals and peritoneal exudates. The treatment usually shows the nature of the infection and provides exclusive specimens.

**Treatment.**—As in local peritonitis incident upon tubal disease, so in general peritonitis the same elements of treatment apply and need not be repeated as to prophylaxis, management, physical measures, medicinal measures and nonoperative surgery. If the gonococcal nature of the lesion is fully established then operative surgery may easily be delayed. All the reasons and conclusions, advantages and disadvantages for such delay have been described under gonococcal tubal disease. The general results of such late surgery are likewise the same, and in the average case are better than early operations. From these facts it follows that conservative technics are far better for the patient than radical steps.

#### GONOCOCCAL INFECTION IN PREGNANCY, DELIVERY AND CHILDBED; GONOCOCCAL INFECTION IN PREGNANCY.

**Occurrence.**—Gonococcal infection is not uncommon among pregnant ignorant women.

**Etiology.**—The pregnancy is the only new factor.

**Varieties.**—Severity, progress, extension and complications are the elements.

**Pathology.**—The lesions in the external organs throughout the infection and those in the uterus after childbirth are the same as those in the impregnated uterus, but more severe.

**Symptoms.**—Subjective, objective, local and systemic data obey the same rule as pathology.

**Diagnosis.**—Establishment of the gonococcus is essential.

**Treatment.**—There is little to add to the standard management of puerperal postpartum endometritis. The disease is grave in its outlook.

#### GONOCOCCAL INFECTION DURING PUERPERIUM.

**Occurrence.**—Childbed infection proceeds from recent or remote foci. The latter class is common among supposedly cured cases and the rarer among the ignorant.

**Etiology.**—The pathology of each of the foregoing forms explains the case fully.

**Pathology.**—The puerperal state is engrafted with acute gonococcal invasion and its previously described lesions.

**Symptoms.**—Early and delayed invasions are seen, otherwise the case has all the clinical features of acute endometritis.

**Diagnosis.**—Childbirth, early recovery followed by acute infection with discovery of the gonococcus, prove the case.

**Differential Diagnosis.**—The reader is referred to works on gynecology for details. The conditions are of two classes:

1. *Conditions Incident to Puerperium.*—Autointoxication, caked and infected breasts, sapremia of retained secundines and accidental pyogenic infection.

2. *Conditions Intercurrent in Puerperium.*—Torsion of ovarian pedicles or pus tubes, appendicitis, typhoid fever, tuberculosis and malaria.

**Treatment.**—The primary focus of infection must be located and cured while the septic state is managed by methods fully described in works on obstetrics.

### AGE AS A FACTOR IN GONOCOCCAL INFECTIONS.

**Significance.**—Old age is rarely but early life often attacked.

**Gonococcal Infection from Infancy to Puberty.**—**Occurrence.**—Gonococcal infections in girls are common through normal patency of the parts. The *Micrococcus catarrhalis* must be carefully distinguished.

**Varieties.**—The same sites, courses, extensions and organisms are recognized as in the adult.

**Etiology.**—The gonococcus is of chief interest. Cases are unexplained or appear after birth or through instruments and utensils. Criminal intent is not uncommon. About puberty the sexual factor appears.

**Pathology.**—The ordinary lesions are seen, followed very commonly by arrest of uterine development.

**Symptoms.**—Subjective symptoms are largely lacking except crying during urination. The other factors are objective proof of vulvovaginitis and the gonococcus.

**Diagnosis.**—Careful examination, well-prepared smears and cultures prove the gonococcal origin.

**Treatment.**—Prevention is important through precautions in every person and utensil used about the female genitals. Expectant gentle measures available for the adult are indicated.

### GONOCOCCAL COMPLICATIONS FROM INFANCY TO PUBERTY.

**Classification.**—As in the adult, the genital and extragenital forms are recognized, of which the latter includes the urinary and systemic types.

#### A. UROGENITAL GROUP.

##### I. Genital Forms.

**Significance.**—Extensions of the disease along the mucosæ into the all organs as puberty approaches are not strictly complications usually so described.

**Clinical Features and Treatment.**—The symptoms and measures are the same as those described for the adult, with strong emphasis on conservatism.

## II. Urinary Forms.

**Significance.**—Involvements of the urinary organs are, strictly speaking, complications.

**Varieties.**—Caruncle, folliculitis, adenitis, cystitis, ureteritis and pyelitis are usual.

**Clinical Features and Treatment.**—The symptoms are the same as in adults with fewer subjective details. Conservative treatment must predominate.

## B. EXTRAGENITAL GROUP.

**Classification.**—The complications are termed according to the systems of the body.

**Clinical Features.**—Susceptibility and lower resistance in childhood are the chief distinctions of the list, including chiefly condylomata acuminata, proctitis, inguinal adenitis, vestibular adenitis, ophthalmia, arthritis with tenonitis and peritonitis.

**Treatment.**—Measures as recommended for the adult are employed.

## GONOCOCCAL INFECTION AFTER MENOPAUSE AND IN OLD AGE.

**Occurrence.**—Compared with midlife the gonococcus is rare after the menopause and in age. The infected disloyal husband and the voracious promiscuous woman herself are the sources.

**Varieties.**—Acute infections are rare. Subacute and chronic conditions antedating into midlife are common.

**Etiology.**—The gonococcus by recent advent or from old foci is the cause.

**Pathology.**—On the basis of much altered organs the familiar lesions are seen.

**Symptoms, Diagnosis and Treatment.**—The complaints, proof and management of these infections are all on fully established lines. Prevention is important.

**Gonococcal Complications After Menopause and in Old Age.**—Physiological alterations of the organs after the menopause and changes in sexual habits make complications very rare indeed.

## CHAPTER XII.

### URETHROSCOPY.

**Varieties.**—As in many other departments of diagnosis the technique varies between the sexes, and one must therefore distinguish urethroscopy in the male and urethroscopy in the female.

#### I. URETHROSCOPY IN THE MALE.

**Urethral Specula.**—Excluding the urethroscope specula are unimportant through difficulties, illumination and magnification for diagnosis and treatment. The Skene-Folsom<sup>1</sup> is serviceable in both sexes aided by the Chetwood lamp. Its features are clear in Fig. 136. More serviceable is the author's<sup>2</sup> short urethroscope based on Chetwood's model, with centimeter graduations for localization of lesions.

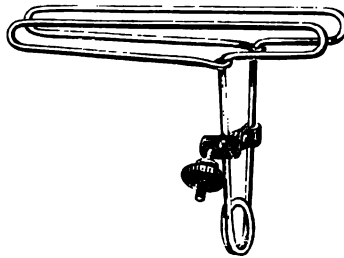


FIG. 136.—Skene-Folsom's dilating, adjustable, wire spring, urethral speculum.

**History.**—The points of advance from the crude to the perfected instrument have included the following important particulars:

1. The source and position of the light.
2. The lens system for magnifying the image.
3. Dilatation by air or water for separating the walls of the urethra and for opening folds, recesses and pockets, so as to afford as nearly as possible the normal condition during function of the urethra and accessibility, for diagnosis and treatment.
4. Position and form of the fenestrum, which is either terminal or lateral, circular or oval, large or small.

The earliest conception was that of extrinsic illumination. The first instruments therefore began to develop this detail.

<sup>1</sup> Diseases of the Bladder and Urethra in Women, 1882, p. 295.

<sup>2</sup> Pedersen, V. C.; Med. Rec., 1913, lxxxiv, 158, also Jour. Am. Med. Assn., 1913, lx, 182.

Bozzini,<sup>1</sup> of Prague, in 1807, was the first to suggest instrumental illumination of the body cavities.

**Types.**—Classification embraces primary and secondary forms.

- I. Primary varieties include definite uses:
  - (a) Examination.
  - (b) Treatment, nonoperative and operative.
- II. Secondary varieties comprise the structure:
  1. As to means of vision:
    - (a) Tubular, earliest and simplest, Nonmagnifying until in latest models lenses were added.
    - (b) Telescopic, containing a true telescope, magnifying direct or lateral fields, inverted or erected images.
  2. As to source of light:
    - (a) Extrinsic, having lamp and head mirror or light outside of sheath.
    - (b) Intrinsic, having lamp integral with the instrument and always within the sheath.
  3. As to object in the field:
    - (a) Inverting, having image reversed.
    - (b) Erecting, having image correct in relations to the urethra.
  4. As to position of field:
    - (a) Direct or axial, with field directly before the observer.
    - (b) Indirect or lateral, presenting field at right angles to the line of vision.
  5. As to preparation of field:
    - (a) Nondistending, without means of filling the urethra.
    - (b) Distending, with air or fluid through inlet but without separate outlet.
    - (c) Irrigating, having inlet and outlet faucets for distending fluid.
  6. As to fenestrum or opening:
    - (a) Terminal, normal or oblique to the axis of the sheath.
    - (b) Lateral, with long axis anteroposterior and short axis involving little of the circumference.

**Optical Principles.**—Tubular urethroscopes began the science with no lenses, with axial vision, extrinsic illumination, at first with not even a head mirror and with distention. As later developments, lenses, telescopes, intrinsic illumination, and distention were developed. Valentine's<sup>2</sup> instrument has been improved by Young,<sup>3</sup> Squier, McCarthy,<sup>4</sup> Hayden,<sup>5</sup> the author<sup>6</sup> and Buerger.<sup>7</sup> The telescopic instruments have true optical telescopes with magnified inverted or erected images in lateral or axial fields under intrinsic illumination and distended in lateral or terminal fenestra. Goldschmidt's<sup>8</sup> urethroscope has been perfected by Buerger<sup>9</sup> and McCarthy.<sup>10</sup>

**Advantages of Extrinsic Illumination Urethroscopes.**—The limitations outweigh the advantages, which are:

1. A full lumen for instruments, without interference by a light carrier.

<sup>1</sup> Weimar, 1807.

<sup>2</sup> *Med. Rec.*, 1895, xlviii, 153 and *Med. News*, 1899, lxxiv, 158.

<sup>3</sup> Young: *Trans. Am. Urol. Assn.*, 1909, iii, 100.

<sup>4</sup> *New York Med. Jour.*, 1910, xcii, 1068.

<sup>5</sup> *Med. Rec.*, January, 1912.

<sup>6</sup> Pedersen, V. C.: *New York Med. Jour.*, October 19, 1912.

<sup>7</sup> *Jour. Urol.*, October, 1917.

<sup>8</sup> *Fol. Urol.*, 1908, ii, 704; *Ibid.*, 1907, i, 107; *Ztschr. f. Urol.*, 1909, iii, Beiheft i, p. 95.

<sup>9</sup> *Jour. Am. Med. Assn.*, 1910, liv, 1045; *Am. Jour. Surg.*, 1915, xxix, 54.

<sup>10</sup> In a personal letter to the writer, April 18, 1917, states: "The prismatic instrument has been shown before various societies—has never formally been published. It has been in use for the past three years."

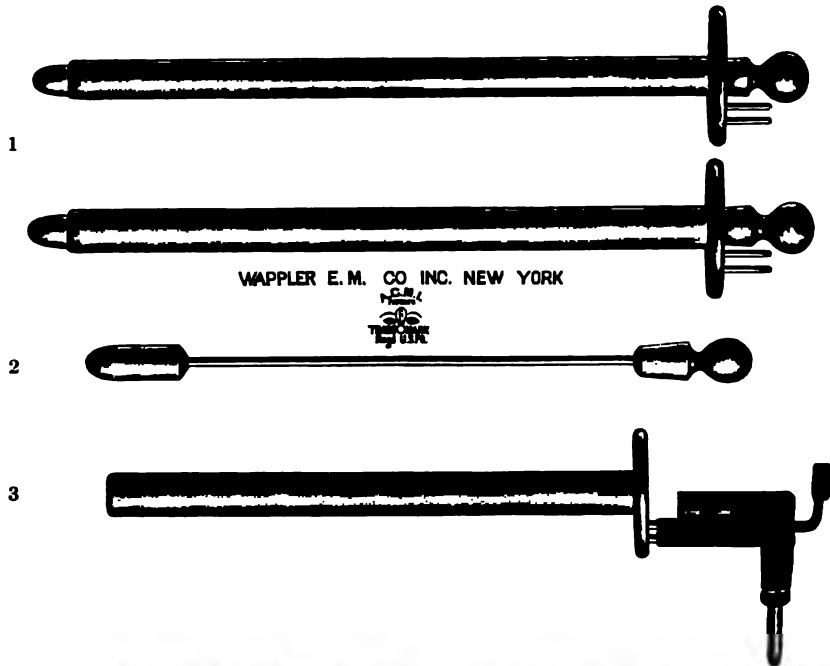


FIG. 137.—Squier's model. Nondilating, extrinsic illuminating, magnifying type. 1, sheaths with obturators; 2, obturator; 3, sheath with lamp and lens. (Courtesy of Wappler Electric Company.)

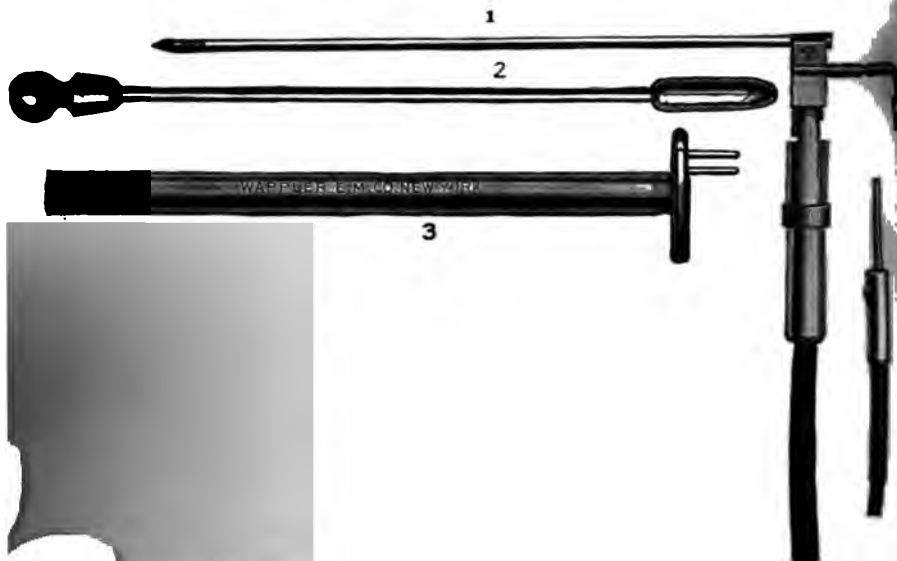
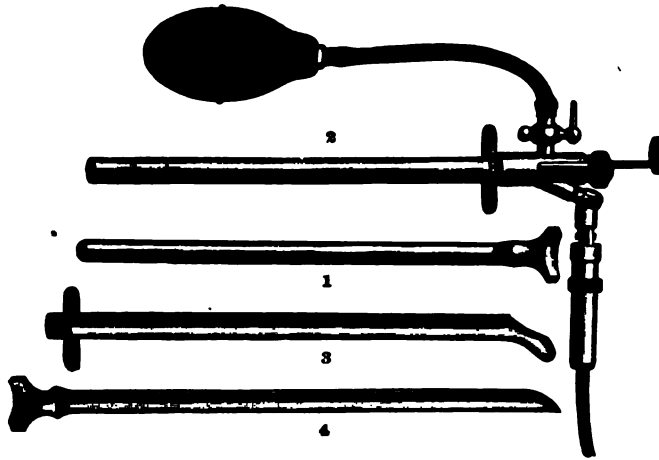


FIG. 138.—McCarthy's model. Nondilating, intrinsic illuminating, magnifying type. 1, obturator; 2, lamp carrier, lamp, lens and conductor; 3, anterior urethral sheath. (Courtesy of Wappler Electric Company.)



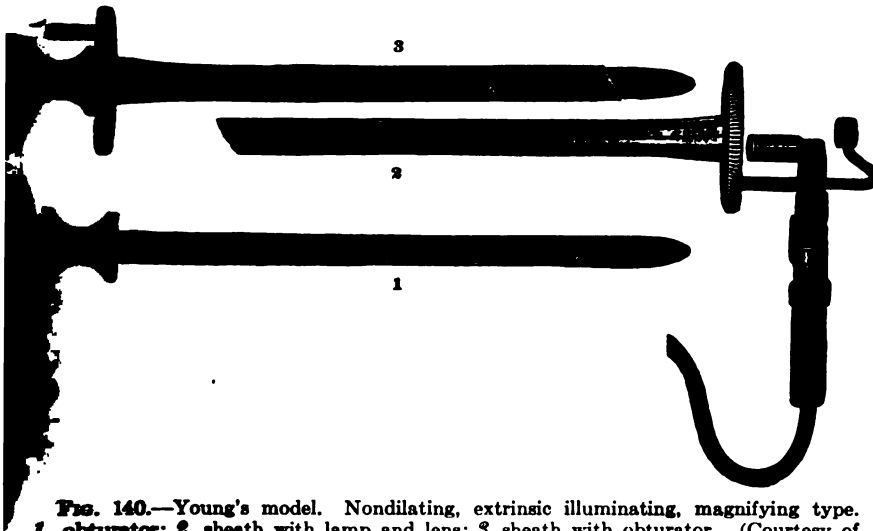
2. A large field, identified with the large lumen and the absence of the light carrier.



**FIG. 139.**—Hayden's model. Aërodilating, intrinsic illuminating, magnifying type. 1, anterior obturator; 2, anterior sheath, with light carrier, lamp, lens, conductor and air bulb; 3, posterior urethral sheath; 4, obturator. (Courtesy of Wappler Electric Company.)

**Disadvantages of Extrinsic Illumination Urethroscopes.**—These are as just stated more important than the benefits and include:

1. Deficient illumination, because light varies inversely as the square of the distance.



**FIG. 140.**—Young's model. Nondilating, extrinsic illuminating, magnifying type. 1, obturator; 2, sheath with lamp and lens; 3, sheath with obturator. (Courtesy of Wappler Electric Company.)

2. Light strong enough to overcome this physical loss casts reflections from the telescope and confuses the eye.

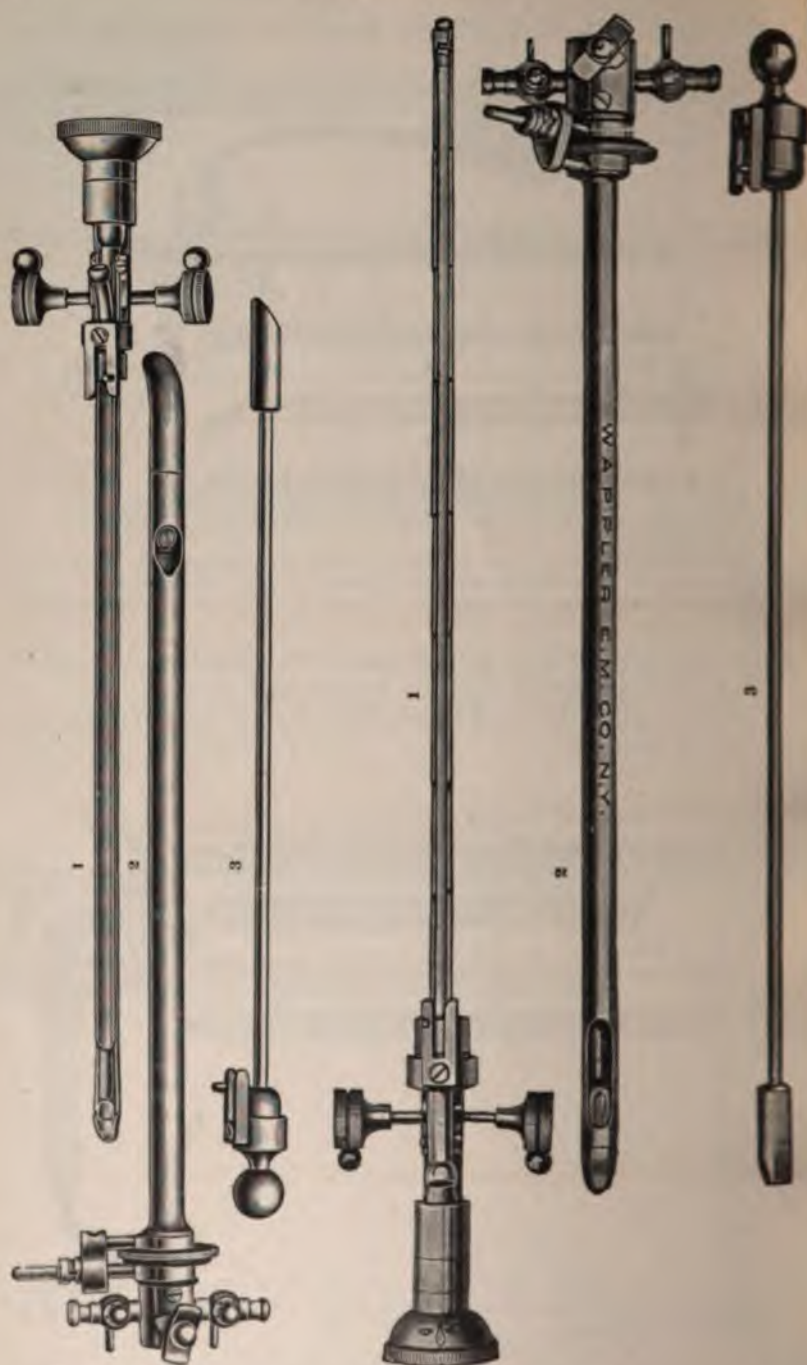


FIG. 141

FIG. 142

FIGS. 141 and 142.—Irrigating, catheterizing and operating cystourethroscopes. Fig. 141, Buerger model; Fig. 142, McCarthy model. 1, telescope; 2, sheath; 3, obturator. (Courtesy of Wappler Electric Company.)

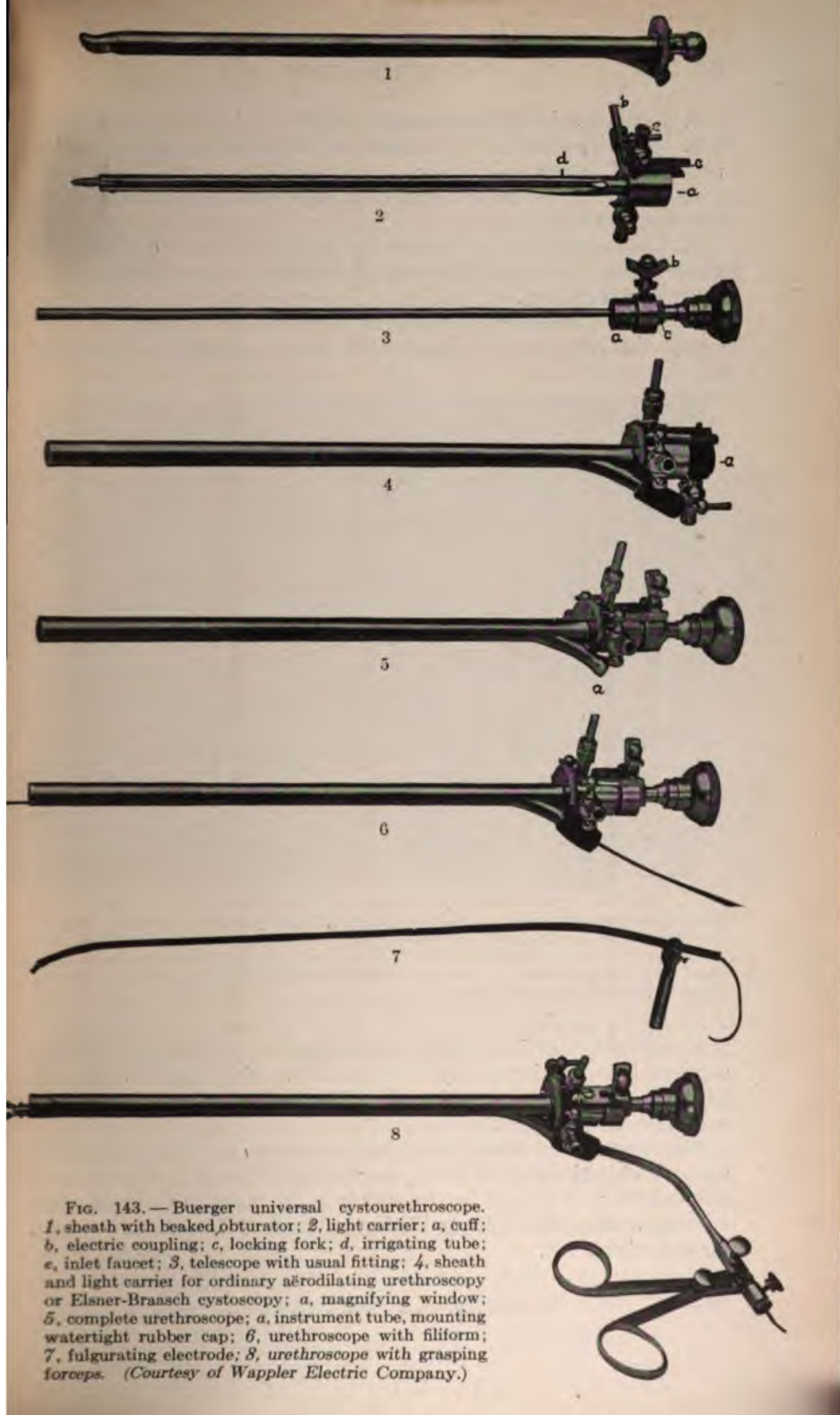


FIG. 143. — Buerger universal cystourethroscope. 1, sheath with beaked obturator; 2, light carrier; a, cuff; b, electric coupling; c, locking fork; d, irrigating tube; e, inlet faucet; 3, telescope with usual fitting; 4, sheath and light carrier for ordinary aërodilating urethroscopy or Elsner-Braasch cystoscopy; a, magnifying window; 5, complete urethroscope; a, instrument tube, mounting watertight rubber cap; 6, urethroscope with filiform; 7, fulgurating electrode; 8, urethroscope with grasping forceps. (Courtesy of Wappler Electric Company.)

3. Restricted definition through the limited light and the re  
 4. Difficulty of centering the rays except in such modern ins  
 as those of Squier and Young.

5. The eye of the observer must maintain constant relation  
 movements of the patient.

6. The lamps attached narrow the lumen for instruments  
 must be removed out of the axis of the sheath accordingly  
 modern instruments.

The V. C. Pedersen<sup>1</sup> instrument is the same as the C  
 except that the sheath is lightly and clearly marked for su

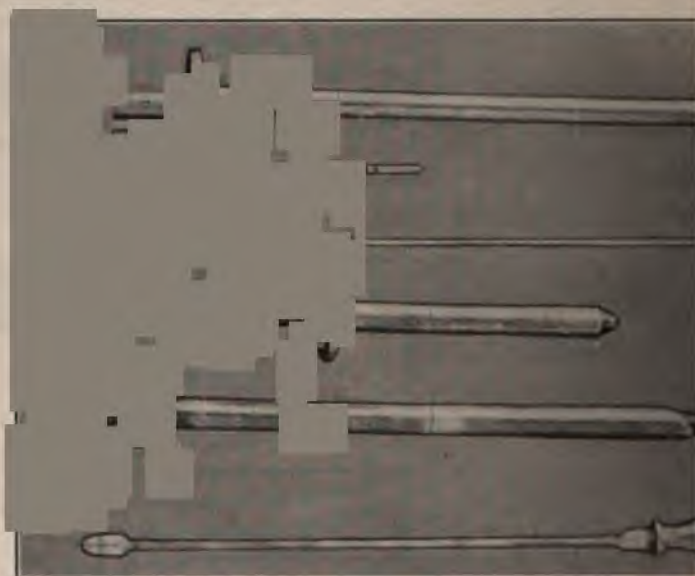


FIG. 144.—Dr. V. C. Pedersen's urethroscope. From above down are se  
 mounting the extrinsic lamp and magnifying lens. Below this are the intrinsic  
 the short and the long forms. Next follows the short form for the anterior u  
 the posterior urethra model with oblique fenestrum and finally the obtur  
 noted that the sheaths are marked in centimeter subdivisions, permitting  
 of lesions from one treatment to the next.

into centimeters or into inches and half-inches. The scales  
 serviceable in locating and relocating lesions which require tr  
 Like the Chetwood instrument it will mount the Squier l  
 magnifier for appropriate cases.

**Disadvantages of Water Dilatation Urethroscopes.**—In ge  
 same six objections urged by Luys against this type of instrum  
 abbreviated in this work by the author in the notes on Golds  
 instrument apply to all water dilating instruments, but the ad  
 far outweigh them.

<sup>1</sup> Jour. Am. Med. Assn., 1913, ix, 182.



**Advantages of Water Dilating Urethroscopes.**—The author would point out the following benefits of the Buerger and other instruments which have largely adopted its design.

1. The optical part or telescope gives the best possible view of the field, far more than the magnifying lenses in the extrinsic illumination instruments.
2. Its devices for passing and directing catheters, wires and similar instruments while the telescope is *in situ* permit very definite treatment.
3. Irrigation and dilatation with water remove exudate and maintain the most normal arrangement of the mucosa.
4. The lateral fenestrum both by withdrawing and rotating the sheath in regular sequence from point to point explores the canal most thoroughly.

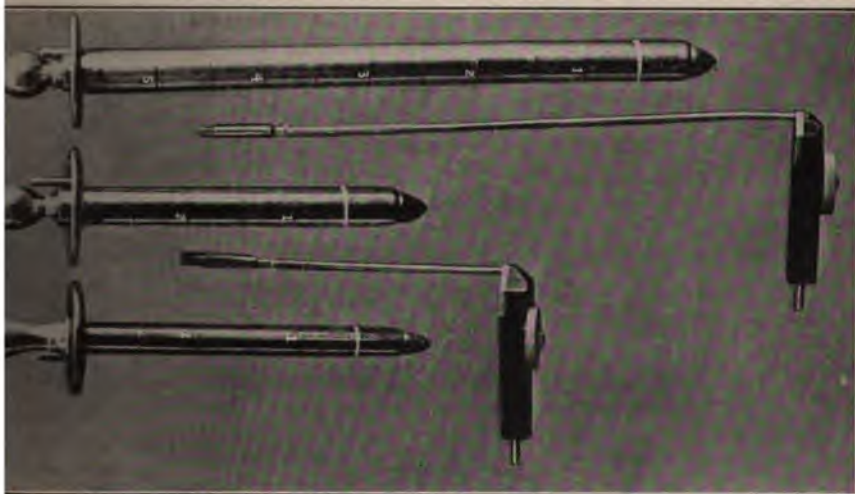


FIG. 145.—Short form of urethroscope; a modification of the Chetwood shown beside it in comparison.

5. Removal of the telescope and suction and drying of the water from the field and application of a magnifying glass as suggested by the author converts the instrument into one for treatment through the sheath alone.

**Choice of Instrument.**—In selecting a urethroscope the author believes that both kinds should be at service and therefore recommends:

1. A magnifying air dilating terminal fenestrum instrument, whose light may be intrinsic or extrinsic according to habit and preference of the operator.
2. An intrinsic illuminating magnifying water dilating lateral fenestrum instrument.

**Accessories of Urethroscopy.** In addition to the urethroscope itself various implements are necessary for the light, dilatation, cleansing,

applications and treatments. The light in the old style of instruments requires a good lamp and a head mirror. This method of illumination is obsolete because very unsatisfactory through the length of tube and the smallness of the field. In the new type of urethroscope an electric lamp outside or inside the tube is supplied with current from a rheostat, cable and cutoff. The dilatation is supplied by the usual bulbs and tubing in the air instruments which are less and less employed and by a Janet-Frank or similar syringe or a reservoir irrigating can and necessary tubing and connections. Cleansing and applications are provided usually by long wooden applicators and cotton swabs. Water may be sucked from the urethroscope by means of a soft-rubber catheter and syringe or various special instruments consisting of a metal tube and bulb. Treatment is medicinal or instrumental or both. The drugs commonly employed are styptics, anesthetics, stimulants and caustics. The best styptic is adrenalin mopped or flooded upon the surface and then dried. Among the anesthetics may be mentioned alypin 2 per cent., eucain 2 per cent., novocain 0.5 to 2 per cent. and stovain



FIG. 146.—Alexander-Janet Record syringe, showing lock ring (c); tip and union disk (b); ground-joint mounting (a).

0.5 to 2 per cent. Stronger solutions may be employed in moderate quantities, remembering that the urethra is capable of very rapid absorption leading to toxic results. The stimulants and caustics are represented by nitrate of silver as the best of all in strengths varying from 1 to 500 to 10 or 20 per cent. The instruments are syringes with long tips for injecting follicles and large syringes for irrigation. The electrocautery, high-frequency machine and cables are important, while scalpels and curettes with long handles complete the list.

**Basis of Success.**—In urethroscopy, as in any other methods of examination, such as cystoscopy, familiarity with the mechanical and electrical details and skill in the introduction and manipulation of the instrument are the first essentials. To these are added complete access to the canal from end to end, dilatation of all cavities, recesses and folds with separation of the walls, cleansing of exudate, proper magnification and easy means of treatment. An instrument which omits any of these fundamentals will not give satisfactory results.

The reader is reminded that many instruments of historical interest have been omitted from this work for lack of space.

**Indications.**—In general urethroscopy is indicated in all forms of chronic urethritis in the shred stage or the relaxed purulent stage, especially when these have been resistant to other forms of treatment. It is essential that the infecting organism shall have become attenuated, few or even absent and above all that the irritability of the canal shall have been determined as very little to invasion by catheter or sound. From these facts it is obvious that any acute lesion forbids the use of the urethroscope, because the shoulder between the sheath and the fenestrum during introduction and the edge of the fenestrum during diagnosis and treatment make it one of the most irritating instruments to employ even with great skill.

A careful multiple glass test should precede the first exploration. The four-glass test of Luys is serviceable as a preliminary index but it omits any exploration of the prostate and seminal vesicles. The author's seven-glass test is therefore to be preferred because it will diagnose lesions in these organs with satisfactory definiteness.

The significance further concerns the doctor, patient and society. For the urologist diagnosis is of supreme importance, especially if it may be combined with treatment by direct and local means. These needs have stimulated a large supply of instruments which may be summed up by those of mensuration and palpation for passage through the canal and location of the lesion and by those of instillation, irrigation and dilatation for treatment. In a certain sense inexact diagnosis and empirical rather than accurate treatment follow their use when compared with the urethroscope. Good light and a proper lens system in the urethroscope add vision to all other methods of diagnosis, and in class this instrument with other modern inspection devices such as the proctoscope, laryngoscope and ophthalmoscope. Lesions may be exactly located and recognized as to nature, such as exfoliations, ulcerations, infiltrations, granulations within the urethra, and such as glandular disease outside the urethra. Treatment may be selected and applied by various methods, notably chemical, thermal, mechanical and electrical means. Surgical procedures such as incision and curetting may be carried out. Variations in treatment in the choice among the foregoing leading methods become available and, what is equally important, the progress of treatment is noted to determine the time and duration of rests between applications and the incidental and terminal results.

For the patient satisfactory knowledge is secured as to why his symptoms continue, why relapses occur, why complications appear and why infection may persist. These important questions are reached by the close correlation between physical examination, urinalysis and urethroscopy whose consistent evidence is required in every case.

For society as well as the patient the urethroscope determines cure and defends the victim against indefinite course of his disease, the wife against innocent infection and the offspring against ophthalmia, vaginitis or similar lesions. Physical examination of all the sexual organs by every means, digital and instrumental, and laboratory exami-



nation of urine, smears, culture and blood is a step in the process hardly less important than urethroscopy, which, however, is perhaps the most valid of all because it locates the lesions and secures the specimens. Cystoscopy must often be added to urethroscopy in such diagnoses. The question of infectiousness of any shreds or other discharge is most important. One examination by any single means such as urethroscopy is misleading and should not be relied on. Most authorities state that three careful investigations should be consistently negative to smear, culture and blood test and that the intervals between them should be not short and uniform, but long and various. The author would add that it is important to associate with such examinations the influence of all important factors such as deliberate errors in diet, alcohol and as the influence of sexual stimulation. The patient should be instructed to return the morning after a seminal emission or after intercourse with a condom in circumstances when the latter test may be morally employed as in protection of the wife. It is a well-established fact that the male and female quiescent or without sexual stimulation will give entirely different specimens from men and women with sexual excitement. This physiologic aid should always be invoked in order to protect the reputation of the urologist for accurate diagnosis and the patient and society against innocent infection.

**Contraindications.**—1. Lack of knowledge of the urethroscopy and its accessories leads to imperfect application and misleading results.

2. Lack of experience with the instrument causes painful introduction, and injuries which may simulate lesions, especially exfoliation of epithelium and points of hemorrhage.

3. Lack of previous diagnosis and exploration of the urethra with bougies and sounds.

4. Lack of previous acquaintance with the nervous and other peculiarities of the patient. As Luys<sup>1</sup> says: "It is reckless to urethroscopically examine immediately a patient whom one sees for the first time."

5. Acute stages or symptoms which contraindicate, also all other instrumentation of the urethra.

6. Special symptoms particularly chordée and tenderness to touch along the urethra and distinct points of ardor.

7. History of frequent relapses, tending to show active or easily provoked foci.

8. Complications in their active or subacute forms, particularly epididymitis, prostatitis and cystitis.

9. Anatomical defects and deformities, especially small meatus.

10. Severe sequels, particularly stricture.

11. Unfavorable reaction to a urethroscopy forbids another for a long time.

12. Luys, as cited, states that one should never urethroscopically examine a urethra which has not been previously examined and well dilated.

<sup>1</sup> A Text-book on Gonorrhea and its Complications, 1913, p. 155, English ed.

**Styptics and Anesthetics.**—Adrenalin in reasonable strength may be swabbed on a given point or in less strength flooded upon the surface of the field and then mopped away. Bleeding points may thus be controlled. The disadvantage is that the anemia resulting from the vasoconstriction is misleading and may simulate an infiltration. With skill local anesthetics are not necessary especially if the passage has been accustomed to sounds. Some patients require injection of the urethra with alypin solution 2 to 4 per cent., which is held in a few moments before using the instrument. After a preliminary smarting, anesthesia is induced which will last for some time. Other anesthetics are novocain, stovain and eucain in solutions of 0.5 to 2 per cent., cautiously applied. Cocain should be avoided or used only with great care on swabs and in weak solution.

**Sterilization and Care of Urethroscopes and Accessories.**—It is well to have a full equipment in both private and hospital practice. After use all blood and pus should be flushed and scrubbed off the instruments and then all parts which may be boiled should be sterilized in this manner. Parts which may not be boiled may be thoroughly scrubbed with a sterilized brush in sterilized water and green soap. This method is reasonably efficient and nearly as good as boiling if well done, as determined by Chetwood,<sup>1</sup> who says as follows: "As to the above matter you are quite right in your recollection that I made, many years ago, an experimental investigation with respect to the sterilization of gum-elastic woven instruments, the gist of which demonstrated that the heads of catheters, after becoming infected with various pathogenic bacteria, could be sterilized with tincture of green soap and a scrubbing-brush, so that no culture could be obtained in bouillon tube or agar." Since this method is proved concerning catheters, it follows that it will usually be reliable for nickel-plated instruments which may not be boiled.

The author keeps all urethroscopic and cystoscopic instruments in a cabinet in which formaldehyde gas is generated one or more times daily from a lamp. Calcium chlorid in a glass, renewed from time to time, absorbs excess of moisture.

In hospital practice in which patients are often examined in rapid succession the author finds the following plan efficient and knows of no transferred infections. The instruments are thoroughly scrubbed in warm water and green soap. Watery solution of green soap is preferred because the tincture attacks the cement around lenses and the insulation around lamps. They are next washed in boric acid water and 50 per cent. alcohol with great care not to bring the alcohol into contact with the lenses and the lamps and finally they are immersed in carbolic acid water 5 per cent. or lysol 2 per cent. These procedures may be done while the patients are dressing and undressing and thus loss of time prevented.

Rough handling of instruments is to be avoided because it scars the

<sup>1</sup> Personal communication to the author, April 20, 1917.

nickel finish, and dropping will dent, buckle or bend the tube, rendering them useless.

**Technic of Urethroscopy.**—The elements of this subject are the preparation of the room, equipment; instruments and patient and finally the introduction and application of the instrument.

**Preparation of the Room.**—The preparation of the room is usually permanent in the office and hospital but in private houses must be adapted to conditions. A room which may be readily darkened and possesses electrical connections and washing facilities is best. Batteries must be taken to the house if no electric facilities are at hand. Where the room cannot be darkened, a sterilized dark cloth may be used over the head of the operator in the manner of the photographer. With its aid the diagnosis is made and then the treatment is employed without this impediment. In hospital or office and so far as possible in private homes, the following floor plan should be followed by the nurse or assistant who prepares for the urologist.

#### FLOOR PLAN: PREPARATION FOR URETHROSCOPY.

##### EVERYTHING POSSIBLE STERILIZED.

WASHSTAND.	OPERATING TABLE.	ELECTRICAL TABLE.
Brushes.	2 or 3 pillows.	High-frequency apparatus. <sup>1</sup>
Soap bichlorid solution.	Blankets.	Generator. <sup>1</sup>
Lysol solution.	Kelly pad.	Switch board. <sup>1</sup>
Boric acid solution.	Stirrups and straps.	Battery box. <sup>1</sup>
	Crank handle.	
NURSE'S TABLE	Pelvis elevated.	OPERATOR'S TABLE.
Towels.	Head high.	Cystoscopes.
Sheets.	Patient comfortable.	Urethral catheters.
Leggings.		Ureteral catheters.
Perforated towels.		Extra lamps.
Cotton balls.	STOOLS.	Rheostat and lamps.
Gauze balls.		Black cloth.
Gauze dressing.		Rubber aprons.
2 pus basins.		Gowns.
Tr. green soap.		Finger stalls.
Bowl boric solution.		Rubber guard.
95 per cent. alcohol. <sup>1</sup>		High-frequency cables. <sup>1</sup>
Drinking water. <sup>1</sup>		Urethroscopes. <sup>1</sup>
Drinking glass. <sup>1</sup>		Applicators. <sup>1</sup>
Drinking tube. <sup>1</sup>		Special instruments. <sup>1</sup>
Watch. <sup>1</sup>		Transformer. <sup>1</sup>
ASSISTANT'S TABLE.		
Boric acid water.		
Bladder syringe.		
Connecting tube.		
Catheters.		
2 test glasses.		
Lubricants.		
4 per cent. cocain. <sup>1</sup>		
2 per cent. alypin. <sup>1</sup>		
Styptics. <sup>1</sup>		
Stimulants. <sup>1</sup>		
Caustics. <sup>1</sup>		

Sterilized cystoscopic dressing set contains 2 leggings, 1 perforated towel, 6 towels, 4 cotton balls, 2 gowns and 6 safety-pins.

<sup>1</sup> On special order only for special cases.

**Preparation of the Equipment.**—The preparation of the equipment is fully provided for in the foregoing plan of the room and makes the instruments and supplies accessible to the operator, assistants and nurses. The author prefers his own table (Fig. 194) as shown under urethroscopy, or one of the other forms of light adjustable office table. The selection of the urethroscope is according to the caliber of the urethra and the portion to be chiefly examined. The short tubes are serviceable in the anterior urethra and the long ones in the posterior urethra. Knowledge of the caliber of the canal and its reaction to instrumentation is essential. A preliminary meatotomy as shown in the treatment of stricture is often advisable because the larger the tube the more definite the diagnosis and the more satisfactory the treatment. The tube and its obturator are assembled, the light tested, the freedom of working parts such as faucets and levers proved, and the magnifying lens suitable for the length of tube ready.

The accessories are already stated in a previous paragraph on this subject and include swabs, probes, forceps, knives, scissors, all of urethroscopic type, chemicals, styptics, anesthetics, high-frequency generator, switch, cables and wire, cautery points and controller and a dimmer rheostat for controlling the light.

**Preparation of the Patient.**—The preliminary preparation of the patient must include familiarity with the meatus, the caliber of the canal as to stricture and allied lesions, the prostate, the testes and penile infection. The latter is all-important because accidental infection of the bladder may be avoided either by postponing the urethroscopy or by extraordinary care of the bladder after it if the lesions show gonococci. As already stated, a urethra which has been repeatedly wounded without reaction is the best for urethroscopy. As far as possible exudate is located by having the patient attend with a full bladder, which is evacuated through the tube, as urination will wash out the discharge and prevent proper observation thereof. This situation is analogous to that in the female, which forbids a vaginal douche before examination.

The *final preparation of the patient* includes removal of the clothing below the waist and adjustment of that above the waist in order to expose the genital organs. Leggings such as are shown in Fig. 193 are serviceable because their bag-form covers the entire lower extremity and their wide mouth is draped above the pelvic bones. A perforated towel such as is shown in Fig. 196 is dropped over the instrument after insertion and adds to privacy for the patient and comfort for the doctor because the peculiar odor from the genitals, especially of women, is largely removed by the towel. With the same objects in view the nurse or assistant should wash the genitals thoroughly. Many patients may do this themselves in gross, leaving lavage of the meatus to the nurse or urologist in fine. The patient sits on the edge of the table as far forward as possible without slipping off, protected by sterile towels. His feet are placed in the stirrups shown in the illustration of the author's table. With the crank the pelvis is elevated until the meatus is at about

the level of the observer's eye and the patient's back, head and neck are made comfortable with pillows and by adjustment of the head-piece of the table. While the surgeon is making final preparation the local anesthetic, if any, is applied. The author is inclined to use less and less anesthetic and to increase his gentleness more and more. For the meatus he prefers one or two granules of neurocaine, such as are used by dentists for the cavities of teeth, consisting of cocain grains  $\frac{1}{2}$  each and providing active anesthesia while melting in the mucus. Eucain, novocain and stovain may all be used in 1 to 2 per cent. solutions. Alypin 2 to 4 per cent. in soft Irish moss jelly is very serviceable for injecting into the urethra.

**Introduction of the Urethroscope.**—The first point is the selection of the type of instrument. The author believes that for the average case the best preference is for the Buerger or McCarthy intrinsic illumination, water dilatation and irrigation, lateral fenestrum, magnifying instrument. Both give opportunity for examining the bladder particularly in its cervical portion and the urethra in all parts and directions during rotation and withdrawal of the instrument in a systematic step by step method. The question of straight or curved beak instruments should be decided in favor of the former. The old doctrine that passage of a straight instrument is well-nigh impossible and always dangerous applies only to the novice. It is the straight shaft of all urethral instruments which rests in the urethra after the curve has reached the bladder and no one has asserted that this straight shaft is dangerous. Such instruments are the common sound, the stone searcher and the cystoscope. Of these the last two are subject to liberal and frequent movements of the shaft in the urethra and always without difficulty if skill is employed. For this reason the writer always employs only the straight urethroscope in both sexes and would emphasize the following steps of its passage into the bladder. The largest diameter of tube should be chosen which will move freely within the canal.

The lubrication of the meatus and the instrument is very important. The writer favors official glyceritum boroglycerini because it is efficiently antiseptic if properly protected from contamination, is fluid and freely soluble and does not irritate the urethra as much as glycerin often does. Irish moss preparations with antiseptics are familiar, but the best of them do not adhere to the instrument as well as the glyceritum boroglycerini. If alypin suspension in thin Irish moss jelly has been used as a local anesthetic no other lubrication is required. Oils and greases are not advisable in most cases, because they often smear the lamp and lenses and render the field very indistinct. On the other hand, however, the writer has found that in sensitive urethræ white vaseline may be smeared on the shaft proximal to the fenestrum and permit practically painless examination. Manifestly this detail must be omitted if treatment other than operation is to be undertaken. This detail of lubrication is especially valuable in cystoscopy, in which the shaft of the instrument occupies the urethra as a whole.



*Steps of Introduction.*—It is important for everyone to learn the steps required for introducing the instrument with a straight tip or a curved tip, so as to take them always gently and almost subconsciously.

*A. Technic for the Straight Tip Urethroscope.*—1. The patient is placed comfortably and fully prepared on a cystoscopic table, with pelvis elevated, back well supported, knees widely separated and feet resting in the stirrups.

2. The patient should present himself with a full bladder, because this is a guide to entrance of the instrument into the bladder and serves to retain, with the least possible disturbance, much of the exudate which the urine would flush out in being voided.

3. The lamp should be tested to show that the entire electrical equipment is in working order.

4. The obturator should be tried in order to be certain that it is not gummed in the tube with blood or exudate improperly removed after the preceding case.

5. If local anesthesia is determined on it must be applied before the lubrication.

6. The urologist stands between the patient's knees and grasps the penis with the left hand and then wipes clean with gauze the glans and meatus and finally lubricates this opening and the instrument with boroglyceride or other preparation.

7. As in passing the sound four manipulations are used, which are gravitation, elevation, depression and penetration.

(a) Gravitation is first and consists in allowing the instrument to slide into the canal vertically by its own weight until it reaches the bulb and stops there. For this reason the largest size of urethroscope should be used which will thus move freely along the canal. The old teaching to use a small tube is now disregarded.

(b) Elevation comprises supporting of the beak of the instrument against the arch of the pubic bone so as to lift it out of the pouch of the bulb. For the beginner and the average practitioner this is best done by inserting the finger, protected with a rubber finger-stall or glove, into the rectum (Fig. 147). The tip of the finger is hooked sharply forward around the sphincter muscle where it reaches the bulb and feels the beak of the urethroscope and supports the latter against the roof of the urethra and the pubic arch and away from the pocket of the bulb.

With later experience the finger may be placed upon the perineum at the base of the scrotum and perform the same function (Fig. 148). Deep bulbs always require rectal guidance, and, on the whole, this is the safest. With still greater skill and longer experience the instrument may be passed in many cases without either rectal or perineal guidance.

(c) Depression consists in carrying the eye-piece downward through an arc of about 90 degrees while the beak rotates under the pubic arch upon the finger until the shaft has the general direction of the membranous urethra into which the finger feels its slide.



The instrument is now held stationary while the finger is slid along it to the apex of the prostate and stops there.

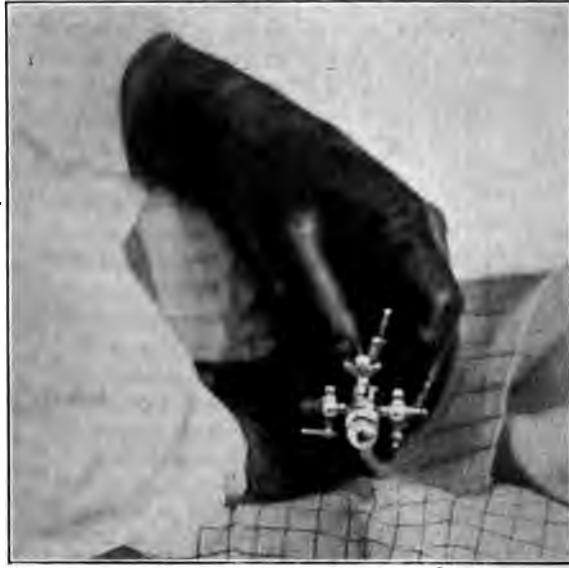


FIG. 147.—Rectal palpation and depression.



FIG. 148.—Perineal palpation and depression.

(d) Penetration is the last detail and consists in passing the instrument along the finger through the prostatic urethra to the neck of t

the cutoff muscle often arrests it until a little gentle pressure is applied to the bladder.

If obstruction by the muscle is unusual it may be concluded that the neck of the bladder is greater than in most subjects. Elevation of the eyepiece and elevation of the beak upward and forward followed by gentle penetration completes the

These steps should be performed deliberately, uniformly, with the least possible pain to the patient.

On withdrawing the obturator, urine flows out. Slight further withdrawal of the sheath checks the flow. Leaving the bladder with urine in it for flushing the urethra completes the procedure. If the bladder is empty, warm boric acid water is introduced into the bladder for the same purpose.



FIG. 149.—Insertion of telescope.

is next attached. If of the intrinsic type it is best placed against the inner wall of the sheath, thus affording better space below it for observation of the floor of the urethra, which contains the more important chronic lesions. The magnifying glass is used as the next procedure.

The exudate is studied as it lies on the surface or is expressed from the tube as the tube is removed, and then it is mopped off with the swabs so that the underlying mucosa may be inspected.

For the treatment of the water dilatation and irrigation type the telescope is inserted (Fig. 149), the exudate noted and then the mucosa is irrigated on a few drachms of water. From time to time the bladder must be protected against undue distention with water and by opening the vent in the sheath and evacuating the

The same processes are repeated in the step by step withdrawal of the tube at the rate of 1 diameter of the fenestrum at a time so far as possible, because the fenestrum represents a field, and one should study the urethra as a total of all the fields. In the terminal fenestrum instruments such fields are, for the most part, presented in perspective as the instrument is withdrawn, but in the lateral fenestrum instruments the field is stretched across the opening and rotation of the instrument through an arc of 360 degrees slowly reveals a zone around the entire canal.

The floor of the urethra is the most important, especially in the posterior urethra and in the anterior urethra along the bulb. Mucous follicles are scattered numerous everywhere along the roof and sides.

The objections to straight beak urethrosopes are usually those of theory, inexperience and prejudice. As already stated, it is the straight shaft of sounds, cystoscopes, stone searchers, stone crushers and the like which without difficulty or injury rest in the urethra, during all manipulations with them. This fact shows that the straight urethroscope may be passed freely and used readily in the canal, whereas one with a curved beak cannot be rotated through an entire circle for studying all sides of the canal without excessive pain. Some of these instruments, such as the Goldschmidt and Swinburne, cannot be rotated at all on account of undue length of beak.

*B. Technic for the Curved Tip Urethroscope.*—All the steps duplicate those laid down for the passing of the standard urethral sounds and need not be mentioned except to refer to the foregoing description.

The limitations of the curved beak urethrosopes have already been detailed in the paragraphs immediately preceding. It follows that only the floor of the urethra is accessible to these instruments, so that through the same step by step study only this portion of the canal may be investigated. The evidence of this fact is the introduction by Goldschmidt of two instruments, one with a curved beak for the posterior urethra and one with a straight beak for the anterior urethra. If Goldschmidt and others had studied the technic of passing a straight instrument gently and successfully the curved urethroscope would have been omitted.

### URETHROSCOPY OF THE NORMAL URETHRA.

**General Principles.**—The anatomical and the clinical features must be distinguished. The former have an important bearing on the latter and must be absolutely familiar to the urologist, otherwise when pathologic conditions are found confusion will arise and error of interpretation will occur.

**Anatomical Features.**—Anatomical features had best be considered from the standpoint of four portions of the canal, in much the same manner as the bladder is subdivided into five portions, according to the recommendations of the author.<sup>1</sup> These urethral segments are the vesical neck, prostatic urethra, membranous urethra and penile urethra.

<sup>1</sup> New York Med. Jour., August 23, 1913.

I. In the vesical neck are found the sphincter muscle thrown into numerous and variously deep folds and the uvula of the bladder continuing caudad into the crista urethræ.

II. In the prostatic urethra, which is about  $1\frac{1}{4}$  inches long, proceeding from the bladder toward the meatus, are revealed: the crest of the urethra continuing the uvula of the bladder and merging with the colliculus. In this body are the utriculus masculinus and the two ejaculatory ducts and on each side are the prostatic sinuses showing very numerous prostatic ducts.

Along the roof of this portion and the side walls are seen numerous mucous crypts, and more prostatic ducts.

III. In the membranous urethra, which is  $\frac{3}{4}$  of an inch long, are seen the folds of the compressor urethræ muscle and more mucous crypts.

IV. In the penile urethra, which is six inches long, are discerned the bulb thrown into numerous folds simulating in miniature a collapsed urinary bladder. It occupies about one inch and contains the ducts of Cowper's glands. Next follows the pendulous urethra for about five inches, containing in any aspect mucous glands, the lacuna magna and the meatus. The mucous follicles in health are scarcely visible, but the author has had one man never infected with venereal disease who showed many easily seen openings. Large follicles may therefore be normal in a few subjects.

In order to provide uniformity of record and observation the writer has devised and for many years employed the following chart. At the bottom of the chart are printed the seven leading characteristics of lesions which must be looked for and recorded. Where a portion of the urethra is normal the name of that portion is simply crossed out with the pen to save writing. The chart has anatomical names abbreviated to save space; for clearness they are printed out in the following copy:

#### V. C. PEDERSEN'S URETHROSCOPIC RECORD CHART.

NAME.

Urethroscopy. Date.

- I. Vesical neck.
  - (a) Sphincter muscle.
  - (b) Uvula vesicæ.
- II. Prostatic urethra ( $1\frac{1}{4}$  inch). A. Floor.
  - (a) Colliculus.
  - (b) Prostatic sinuses.
  - (c) Right ducts.
  - (d) Left ducts.
  - (e) Middle ducts.
  - (f) Utriculus.
  - (g) Right ejaculatory duct.
  - (h) Left ejaculatory duct.
  - (B) Roof.
- I. Membranous urethra ( $\frac{3}{4}$  inch).
  - (i) Compressor urethræ muscle.
7. Penile urethra (6 inches).
  - (j) Bulb (1 inch).
  - (k) Cowper's ducts.
  - (l) Pendulous urethra (5 inches).
  - (m) Mucous glands.
  - (n) Lacuna magna.
  - (o) Meatus.

Color, vessels, edema, elasticity, crypts, growths, ulcers.

By employing abbreviations this urethroscopic chart may be printed alongside of the cystoscopic chart shown in the Chapter on Cystoscopy, so that the record of both examinations may be arranged in parallel columns.

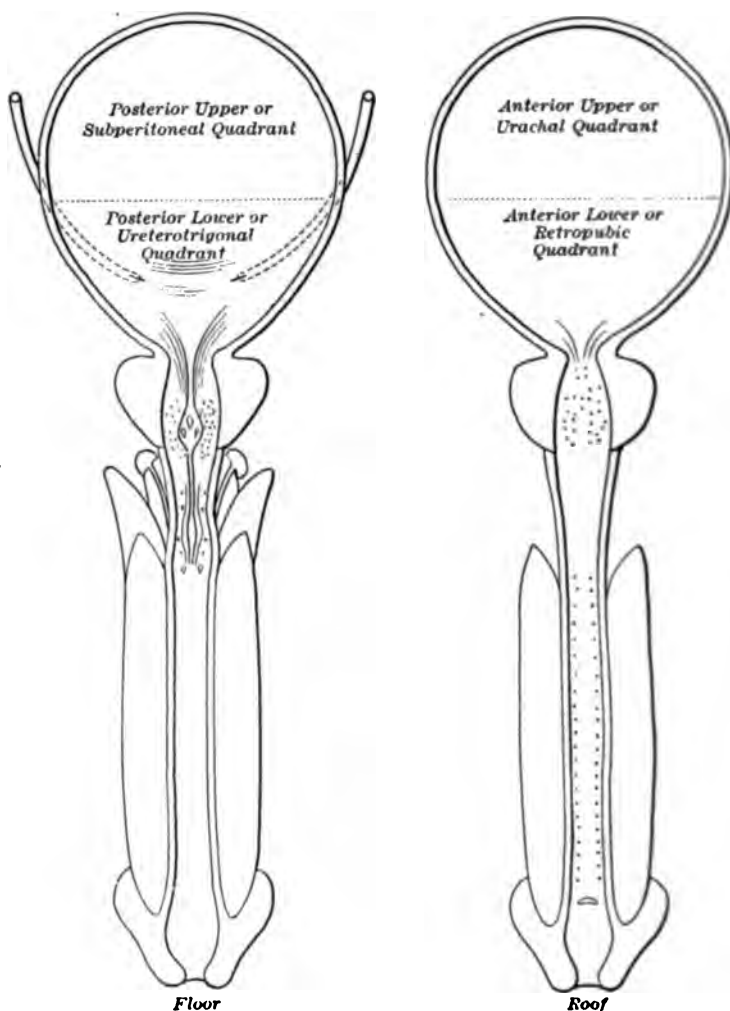


FIG. 150

FIG. 151

FIGS. 150 AND 151.—V. C. Pedersen's diagrams of the male bladder and urethra.

In order to plot the findings of the examination the foregoing diagrams have been devised by the author.<sup>1</sup>

For the female urethra and bladder the same plan may be followed as designated by the author. It must be remembered that the female urethra is the same as the prostatic urethra without colliculus, ejacula-

<sup>1</sup> Loc. cit.

tory ducts, utriculus, prostatic ducts and prostatic sinuses. Its chief features are numerous mucous crypts scattered everywhere and the glands of Skene.



FIG. 152

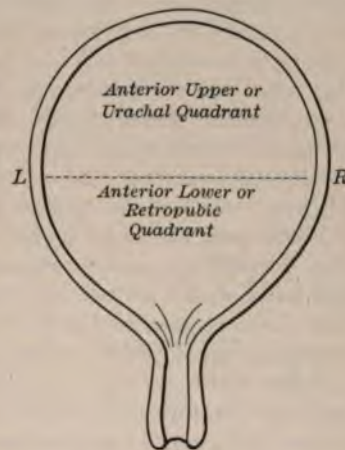


FIG. 153

**FIGS. 152 and 153.**—V. C. Pedersen's diagram of the female bladder and urethra. Show the same plan of topography applied to the female bladder. Without necessity of a separate cut the female urethra may be drawn in over the male and the same plan of procedure followed as with Figs. 150 and 151. There may, however, be some physicians who see only female cases, to whom Figs. 152 and 153 will be of value.

### Normal Clinical Features of Urethroscopy.

**General Considerations.**—Like the anatomical features, the urologist must become familiar with the clinical features, first the normal and then the pathological. The chief details of such knowledge are the mucosa in its thickness, attachment, vessels, color, elasticity, crypts, glands, laxity and folds.

The thickness varies largely with the individual. The mucosa is always a delicate membrane which must be approached with gentleness and deliberation, but in some subjects it is much thinner than in others, especially if it has never been diseased. Contrariwise, in a urethra which has been often infected it will be found thick and dry in some places much more than in others, and sometimes great extents of the canal are so changed.

The attachment of the membrane to the underlying parts is an accompaniment of the thickness. In the spongy urethra it is less free upon the underlying connective tissue than in the bulb where this pouch by suffering dilatation requires an expanse of mucosa which lies in folds when the bulb is inactive. As the mucosa thickens with disease such freedom is reduced and even lost.

The color is the rosy red of the mucosa everywhere in the body, due to great vascularity and delicacy of the overlying epithelium. Such is



the color when the meatus is opened and naked-eye inspection used, but when a urethroscope is introduced its own pressure or that of the dilating air or water will make the color much paler and sometimes patchy. Less commonly the instrument will cause circulatory obstruction and deepening of the color to a livid red. Shifting of the instrument by relieving the pressure will change this lividity back to normal or nearly normal hue.

The vessels are indistinct, as a rule, even under magnification, but the same factors which change the color will bring into greater or less prominence single or grouped vessels, which will stripe the field in beautiful and various figures. Before concluding that a pathologic condition exists, the instrument must always be shifted or the amount of dilatation decreased or increased. Prominent vessels which do not change accordingly may be regarded as associated with another lesion whose location and nature must be sought.

The elasticity consists in freedom of response under changes of the air or water used for dilatation and under shifts of the instrument. The folds chiefly change, and, as in the urinary bladder, show the presence or absence of infiltration. Necessarily elasticity is combined with the features of thickness and attachment. The normal urethra has in these senses no fixed parts, but bulges into the tube as it is advanced or recedes from it as it is withdrawn.

The crypts and glands are in health invisible except in rare cases. If seen they look like small, open needle pricks scattered everywhere but chiefly along the roof of the pendulous urethra and less frequently along its sides and floor. In the prostatic urethra they seem to be chiefly on the roof while the ducts of the prostate are mainly on the sides and floor. The author has had one man, who although never having had venereal infection showed along the roof of his penile urethra almost as many large crypts as are seen after a urethritis. Such an observation suggests that open glands may be normal in a few patients.

The laxity and folds of the mucosa are seen chiefly in the bulb and membranous urethra, where they are required for accommodating the canal to muscular action and dilatation with fluid naturally passing during urination or copulation. They would be present in the prostatic urethra were it not for the fact that the prostate is a firm body and has the mucosa relatively closely applied to it. Its own diameter is such that dilatation is already provided for in this the largest part of the canal. In the spongy urethra the mucosa as a whole is deeply folded to the vision of the urethroscope. There are also a few transverse bands which cross the canal, particularly at the angle between the penis and scrotum.

**Field of the Urethroscope.**—The field of view of the urethra is determined by the form and position of the fenestrum—round or oval, terminal or lateral. The form of the fenestrum is of little influence unless it is very large, as in the Goldschmidt instrument, and thus passes somewhat out of the observer's control.

**Terminal Fenestrum Instruments.**—The end opening gives a central image or figure of the mucosa, which varies between a cone as the instrument is withdrawn and a dimple as the instrument is advanced. These results are due to the wall as it recedes from the mouth of the instrument and collapses to appose its surfaces, thus forming the funnel, or are due to the elasticity of the wall as it gently impedes the progress of the instrument and pouts into it to form the dimple.

The cone is like a funnel and has its apex distal and its base at the margin of the tube and its walls extending between and comprising the mucosa available to view. Withdrawal of the instrument increases the cone by making tension on the canal while penetration reduces it and converts it into the dimple. Traction on the penis and tube together so elongate the cone that it becomes practically tubular, with its apex beyond good illumination of the instrument. The advantage of this technic is that glandules if diseased form little prominences along the surface as it recedes into darkness.

The cone is most prominent in the anterior urethra, and, as stated, consists of apex, surface, margin and base. The apex is usually not remote, hardly more than the diameter of the field, and according to the direction of the tube is centric, eccentric or absent, and may be changed from any one of these three to any of the other positions by twisting or shifting the fenestrum. Its surface is thrown into little folds or ribs radiating from the apex to the margin and representing the early collapsed condition of the lining at the apex to the stretched-out condition at the edge of the tube. The number and changes of these folds are signs of the elasticity, attachment and freedom of the membrane. The margin of the cone is determined by the edge of the instrument and the base of the cone, as a geometric entity, is absent because it corresponds to the fenestrum itself. The general form of the cone changes with the segment of the canal under examination and from behind forward, which should always be the manner of a complete urethroscopy, extending from bladder to meatus; the central figure shows the following differences:

The posterior urethral picture is semilunar, determined by the form and size of the colliculus as it mounts upward against the roof and pushes it away from itself. The membranous urethral feature is a chiefly folded wall and small apex. The bulbous urethral figure is more or less a vertical slit due to the redundancy of the canal at that point. The anterior urethral cone has an oval slit for its apex, which is due to the arrangement around the fossa navicularis and glans, and farther back the form is irregular.

The surface of the cone is the surface of the mucosa with its striations and gloss. The radiating folds form the striations and are few or many, prominent or slight, according to the freedom of the mucosa and the size of the tube. They may be made to disappear at will by shifting the instrument or by changing from withdrawal to penetration. They are also due to the vascular arrangement and are in health relatively slight. The gloss is the normal smooth unbroken epithelium with the

moisture as it passes across the field under the glare of the light. The membrane in health appears smooth exactly as accessible portions are smooth to touch. The margin of the cone underlies the edge of the tube, whose pressure changes the vascularity actually and the gloss apparently. Whether or not a pathologic condition is present is shown by restoration to normal as the instrument is shifted.

#### SPECIAL FEATURES OF THE NORMAL URETHRAL SEGMENTS.

**Proper Urethroscopy.**—This investigation must begin at the neck of the bladder and end at the meatus so that in regular order the segments are: neck of the bladder, posterior urethra, membranous urethra, anterior urethra and meatus. This order will be followed in the description. It is understood that in health all the features of the mucosa are present and that such factors as great redness, prominent vessels, edema, inelasticity, discharging crypts, infiltration, growths or ulcers are all absent.

**I. Vesical Neck.**—After brief inspection of the trigonum and ureters, for which the cystourethrosopes, such as Buerger's or McCarthy's, are far preferable to the terminal fenestrum instruments, the vesical neck comes into view and presents the sphincter muscle which by its purse-string action shows numerous deep, longitudinal folds, and the uvula vesicæ, which is a prominent ridge on the floor passing caudad out of the bladder, where it merges with the crest of the urethra.

**II. Prostatic Urethra.**—The floor is much more important and presents the following features for inspection. The crista urethræ continues from the uvula of the bladder to the upper margin of the colliculus, which is semiovoid, with its long axis longitudinal, its short axis transverse and its half-axis vertical. It is normally rather pale perhaps from pressure of the instrument or the dilating fluid. Its tunic of mucosa fits firmly and has no folds. The prostatic sinuses situated on each side along the base of the colliculus are potential pockets until opened by air or fluid. Their inner walls are formed by the colliculus and their outer wall by the lateral lobes of the prostate. In the cavities of these folds are the prostatic ducts, which are chiefly right and left and a few central. They are spread out along the lateral walls of the sinuses and around the base of the colliculus. A few of them occur on the roof. In health they are scarcely visible.

The utriculus is embodied in the colliculus, a little anterior to the summit and in the middle line, but it may be posterior to the summit and difficult to find with the terminal fenestrum instrument. Its opening resembles in miniature that of a ureter. Its depth is little or great according to development and varies from about 0.5 to 2 cm. or more. In disease it may be greatly altered.

The ejaculatory ducts are right and left on either side of the utriculus and commonly below it. They likewise resemble in a still further reduced size the openings of ureters. In health they are very difficult to see and resemble minute folds longitudinally placed. In disease

their alterations involve great changes in their normal, smooth, clean-cut margins exactly as those of the ureter are profoundly altered.

Along the prostatic urethral roof are found the ducts of the anterior lobe of the prostate, which are with difficulty visible in health and even more so than those of the lateral lobes in the prostatic sinuses. Numerous mucous crypts are present along this region, which, like those elsewhere in the urethra, can hardly be made out. Folds in the mucosa are also common in this region, but they are less numerous and deep than elsewhere because the prostate is a rather rigid body through which the urethra passes with its lining.

The general impression of the prostatic urethra is that of a spacious more or less fixed pocket or segment of the urethra.

**III. Membranous Urethra.**—This portion is only three-quarter inches long and is confined between the layers of the triangular ligament. The fascicles of the compressor urethræ muscle throw the mucosa into folds although this segment of the canal is held by the ligament as the most fixed part of the urethra. Mucous follicles are numerous but difficult to locate in health. The muscle and the ligament both hold the tube more in this portion than elsewhere, so that as the tube leaves the entrance of the membranous urethra it is liable to jump unless the urologist is cautious to avoid this pain for the patient. The general impression of the membranous urethra is that of a fixed deeply folded canal.

**IV. Penile Urethra.**—This portion, also called the spongy urethra, is six inches long and includes the bulb and the pendulous urethra. The bulb, one inch long, is interesting on account of its size, depth of folds and general laxity, closely resembling a diminutive urinary bladder. Under dilatation its folds may be made to change and nearly disappear. It is sometimes so deep that the fenestrum must be crowded into it for illumination and inspection. It is occasionally so shallow that one is perplexed as to its limits. Under the flush of irrigating water its walls come and go as nowhere else in the canal—a fact which constitutes the chief diagnostic point of its situs. Mucous crypts are numerous and the ducts of Cowper's glands are near the middle line and the distal portion of the bulb.

The pendulous urethra, five inches long, shows a more constant cone than anywhere else in the urethra and its apex varies in general form from a more or less irregular point at the penoscrotal angle, through a transverse slit along the middle segment, to a vertical slit in the fossa navicularis and meatus. Its walls show usually the most numerous and deep folds as one proceeds caudad from the bulb. The only exception to this statement is the bulb itself. In the fossa navicularis the folds disappear because the body of the glans supports the mucosa firmly. The absence of folds is the diagnostic point of this region. Vascular striæ vary with the individual, the pressure of the tube, the traction on the penis by the urologist and the influence of dilating air or water. They may be most clearly outlined as hair-like capillaries against the yellowish-red mucosa or they may be vessels



of much larger size through any of the foregoing factors. Disease produces profound changes which should always be traced to their sources.

The lacunæ of Morgagni are present almost entirely along the roof of the urethra. They may be few or many according to the anatomical development in the individual. In health they are not very distinct. The case noted by the writer on page 646 tends to indicate that they may be normally very large.

The glands of Littre are the mucous crypts or follicles and are necessarily scattered everywhere. Like the lacunæ they may be difficult to see in health or may resemble unhealed needle pricks. Disease may profoundly alter them and their annexa.

The general impression of the penile urethra is that of an elastic tube.

**Lateral Fenestrum Instruments.**—The side window changes the field materially from that of the terminal fenestrum urethroscope. The field varies according to the size of the window and shows neither corner nor dimple, but a mucosa stretching along the urethra and itself lax or tight according to the portion under examination and the presence or absence of dilatation. Such a field might be called a diaphragm across the lateral fenestrum, just as the collapsing urethra is called the cone or funnel beyond the receding terminal fenestrum. Rotation through an arc of 360 degrees at a given point of the canal gives a complete circular zone of the wall at the same point. If now the tube is withdrawn the distance of the long diameter of the window a new zone is reached continuous with the one first seen. A combination of such rotation and such withdrawal constitutes step by step study of the canal. Instruments with unduly large fenestra, such as the Goldschmidt, present more mucosa than can be controlled or examined because illumination and magnification cannot be applied to extensive regions. The telescope in having a fixed focal field is much better suited for studying the whole region and the features of the mucosa from the bladder at the ureters, trigonum and neck to the meatus.

If one wishes to study the floor of the canal first from end to end it is necessary only to keep the fenestrum in the middle line and to withdraw it field by field. At other visits the roof and the sides may be individually inspected, but the author prefers the step-by-step combined rotation and withdrawal method, which usually completes the work at the first examination.

The image, with the exception of the cone and the radiating folds with their respective variations, is the same in its general features as the lateral field instrument as in the terminal view urethroscope. One therefore seeks to recognize the special features of thickness, attachment, color, vessels, elasticity, crypts, glands, laxity, folds and gloss.

Familiarity with the normal urethra is very important and can be gained only by persevering examination of every patient possible. One has never had venereal disease but who offers functional disorders as reasons for urethroscopy. In this way the art of urethroscopy

alogous to that of ophthalmoscopy, proctoscopy, rhinoscopy and the e, in all of which the normal standard is learned only by examining merous patients. In the same class also is found digital examination the prostate to distinguish the normal from the diseased and to quire diagnostic and therapeutic skill.

### **Pathologic Clinical Features of Urethroscopy.**

**Varieties.**—As elsewhere in this work the classification into gonoccal and nongonococcal forms will be observed. The type taken for andard and comparison is the gonococcal. The other lesions are ually important although relatively uncommon.

### **Gonococcal Lesions in Urethroscopy.**

**General Considerations.**—Each of the features mentioned and dissed under normal urethroscopy should be taken up. Convenience ggests the same order as that already shown: thickness, attachment, or, vessels, elasticity, crypts, glands, laxity, folds and gloss.

**Thickness.**—According to degree and age of the inflammation the nsity of the mucosa changes from a relatively soft edema and infil- tion of the subacute stage to a dense replacement of the mucosa in rd infiltration and stricture. Both are accompanied by glandular anges of the common types—namely, those without occlusion of cts and retention of secretion and those with both phenomena as er discussed under the heading of glands.

**Attachment.**—Where thickness has been increased and the mucosa s lost all apparent freedom of motion on the underlying tissue the achment may be regarded as close. There is no change in the minal or lateral picture of the mucosa in response to fluid, as it runs o the canal or as the membrane recedes from the instrument as it vithdrawn.

**Color.**—The fine fibrillation of capillaries of the normal mucosa nges to hyperemia—passive or active. Passive turgescence is seen ally caudad to an obstruction and in the urethra it is common in ociation with stricture and is comprised chiefly of venous engorge- it. Active hyperemia is seen cephalad to stricture where the more ve inflammation is still existent, and it consists chiefly in arterial llaries. Around granulations, glands and other chronic changes process is often present. Pallor indicates obliteration of vessels ellular proliferation such as embodies a stricture.

**vascularity.**—Changes in the bloodvessels account for those in color are therefore hand in hand with all the foregoing factors. Passive eremia shows obstruction which is cephalad to it, while active escence, on the other hand, is found where inflammation is going on hat it appears with glandular disease and cephalad to infiltrations stricture and in zones of granulation. Caution concerning the sure of tube or fluid in producing such appearance must ever be in



mind and vessel changes should be patiently traced to their cause and diagnosis. Absence of bloodvessels is always seen where scar tissue has obliterated them.

*Elasticity.*—Infiltration of the mucosa with small round cells in acute inflammation later changes to connective-tissue cells in chronic processes, and thus are respectively constituted the soft infiltration or edema and the hard infiltration or stricture. All degrees from the soft lesions of subacute urethritis to the moderately firm fixed stricture and the very dense scar with changes in the glandular vessels are seen. All are recognized by the sluggish collapse of the urethra, the reduced or absent folds, altered apex of cone, pale rather nonvascular walls, enlarged crypts and failure to respond to dilatation. The more active lesions are cephalad to the zone of inelasticity.

*Crypts, Glands and Lacunæ.*—As these details are all different developments of gland they have much the same processes in kind and degree. The lacunæ of Morgagni are the largest and the most distended glandular. Oberlaender<sup>1</sup> regards chronic urethritis as of two forms: soft infiltration and hard infiltration, and further subdivides the changes of glandular changes into two: Degree I is folliculitis without retention in which the ducts are patent and the secretion discharged, and Degree II is folliculitis with retention in which the ducts are occluded and the secretion retained. In early hard infiltration and glandular disease without retention the glands are discrete or grouped, enlarged and inflamed, but the inflammation is relatively slight and not a barrier to the ducts, otherwise they would be occluded. The secretion from the glands causes the moisture and the shreds. If the glands are occluded and their secretion retained the hard infiltration is around them and the secretion cannot escape but goes on to form cysts, appearing as beadlets along the mucosa. Atrophy of the gland commonly follows and the whole process is dry.

In more advanced hard infiltration and glandular disease, with retention the grouping, enlargement, inflammation and infiltration are all more marked but the ducts are still patent, red and conspicuous. Moisture and discharge are still present but thicker. In glandular disease with retention the infiltration is still further advanced and obvious. The ducts are densely closed, the glands atrophied and rather than cysts represent their positions. There is no secretion and therefore no discharge.

*Laxity and Folds.*—Changes in these details follow those of thickness and elasticity and are virtually manifestations of both. Both degrees as cellular substitutions supervene. In fact, it is the alteration from laxity and the folds which designates those in the thickened zone of elasticity.

*Gloss.*—The normal luster is pronounced from the smoothness of the epithelium, the moisture and the vascularity of the membrane. Es-

<sup>1</sup> Die chronische Gonorrhoe der männliche Harnröhre, 1910, ii, p. 110.

tion, granulation and ulceration show a loss of gloss through varying degrees of destruction of the epithelium, and each has its characteristic raw base in ascending order as stated. Hypertrophy and cellular substitution in stricture deprive the surface of luster through absence of bloodvessels, trophic changes and alteration in color from a yellow red to a patchy-white. Some of these surfaces look granular and roughened.

In a previous study the author<sup>1</sup> has reviewed the causes of chronic urethritis from their anatomical basis in the following terms:

"The causes are anatomic, physiologic and pathologic. The anatomic causes are inherent in the fact that the various portions of the urethra more or less tend to invite infections of the gonorrheal type and its corollaries. For example, we know that the prostatic urethra is normally the widest part of the urethra in diameter and is bounded behind by the sphincter and in front by the verumontanum. In this pouchlike cavity, therefore, the gonorrheal pus may lurk, and there set up those changes in the mucous membrane that are seen everywhere in other mucous membranes as the signs of persistent inflammation.

"Passing forward to the verumontanum and the right and left prostatic sinuses on each side of it, we again find a complex anatomic arrangement, in which the inflammation may very easily reside and from which it is not easy to drive it. The posterior extremities of the prostatic sinuses, called the prostatic fossettes, may be so shallow that they are difficult to recognize, as offset from the floor of the urethra on either side of the crest; or they may be so deep as to be difficult to illuminate and inspect with the urethroscope. This form of prostatic sinus usually has its floor thrown into folds, which only complicate the difficulty.

"Where the verumontanum rests against the lateral prostatic lobes, the sinuses are long, narrow and relatively deep, and invite the formation of granulations therein, with or without papillomata.

"The fact that in these special parts of the urethral tract the walls are in apposition, much more closely indeed than are the walls of the urethra itself as a whole, tends to invite and augment those changes in the mucous membrane which the disease produces only too actively, even where there is no such close contact. If one may draw an analogy of this condition, it would be the persistence with which the victims of eczema suffer from eczema intertrigo wherever the skin makes an angle, is folded upon itself, and remains more or less in contact, as behind the ears and in the cavities of the armpits, elbows, groins, buttocks, knees and interdigital spaces.

"The great frequency of prostatic ducts along these walls invites the penetration of infection therein by the imprisoned pus. The roof of the urethra in the prostatic region frequently possesses a number of folds, from which proceed the fact that cysts of the roof are so common.

<sup>1</sup> New York Med. Jour., October 19, 1912.



"The membranous urethra is a little less apt to be involved on definite anatomic grounds. The bulb, however, which is the next important part of the urethra, is far otherwise in its anatomic relations. It may be a slight or an extensive pouching of the ordinary passage. In the former case, lesions of its floor seem to be relatively infrequent. In the latter, however, one not uncommonly finds an interesting variety of conditions. The circular fibers of the urethra about the bulb are sometimes seen to throw the floor of the bulb into transverse folds precisely like a miniature of the bladder. The mucous membrane as a whole may be rough, shaggy, or the mucous crypts may be infected. Ulcers and strictures, strictly as such, are sometimes seen at this part.

"In the anterior urethra, the normal arrangement is the presence of numerous mucous follicles along the dorsum, any one or few of which may become involved and go on indefinitely to chronic suppuration.

"Most anatomists assert that the anterior urethra has normally large mucous crypts, whose mouths are visible to the naked eye in the adult. It would be interesting to make a study of this fact, because I have recently urethroscopied one adult who never had had venereal disease, whose urethra showed at no point an enlarged mucous follicle excepting the lacuna magna. He was subjected to this examination for its moral effect upon his neurasthenia, which had a sexual basis. It is a well-known fact, however, that mucous crypts are not only of simple, but also of complex types, so that they do not only constitute little cuplike depressions, but may pass along under the mucous membrane, so as to form more or less angulated cavities. In such cavities as these crypts then form, the gonococcus may abide for life and defy all human skill in eradicating it.

"Last and not least is the anatomic fact that the urethra at rest is a closed, collapsed tube with walls in apposition, which only tends to imprison discharge somewhat and grant the gonococcus still more opportunity to penetrate.

"The physiologic causes of the chronicity and persistency of gonorrhea embrace the two features of the normal activities of the various glands throughout the urethra, and the normal sexual activity of the various organs comprising the general external genitals. Thus it is that irritation and hypersensitiveness which accompany chronic involvement in a more or less degree tend to stimulate the sexual activities. This disturbance, in turn, inclines to invite penetration and prolongation of the trouble.

"The pathologic causes rest particularly in the nature of the gonococcus and those germs which frequently accompany the gonococcus and penetrate into the deeper regions of any portion of the body surface attacked. Therefore, when the anatomic and physiologic conditions have played their part, we find the disease has penetrated into the mucous follicles, the prostatic ducts, the seminal ducts, and the outlet of Cowper's glands (to say nothing of the seminal vesicles, vasa deferentia, testes, etc.), from which it is extremely difficult to eradicate.

"The pathology of chronic mucous membrane inflammation is w

known and differs in no degree or detail in the male urethra from the pathology of every other mucous membrane, in male or female, in child or adult, namely, thickening of the mucous membrane as a whole, cystic degeneration, involvement and obliteration of the mucous crypts, unhealthy granulation tissue, in spots or more or less disseminated. Where folds occur, these granulations go on to the formation of warts, which act as foreign bodies and produce a chronic discharge, germ-bearing or not, as each case develops, and not infrequently to the causation of symptoms of stricture."

#### SPECIAL FEATURES OF THE PATHOLOGIC URETHRAL SEGMENTS.

**Complete Urethroscopy.**—As noted under this subject in the normal urethra the work must be begun within the bladder and terminate at the meatus. Under the subject of indications it is shown that every chronic urethritis should receive a urethroscopy, because lesions may exist at any point and demand treatment, although they may give no focal symptoms of importance. Lesions of the mucosa are known to occur notwithstanding negative results of a physical examination, with urethral instruments, rectal touch and laboratory examination. The urethroscope is the one instrument which will reveal exact conditions, and it should be used as faithfully as other modern electrically illuminated diagnostic instruments, such as the ophthalmoscope, laryngoscope, rhinoscope, auroscope and the like. The rule is therefore safe that a urethroscopy should be done even when the prostate gland as a secreting organ seems normal and when a multiple-glass test, such as the seven-glass test of the author, gives no positive findings. Even indefinite subjective symptoms will proceed from a damaged mucosa.

In short, a competent and complete urethroscopy is the final step in diagnosis in all cases of chronic urethral lesions. It is already well known that acute urethritis contraindicates it, likewise acute exacerbations of complications.

**Vesical Neck.**—*Urethroscopic Picture.*—This transitional point between the bladder and the urethra is an index of the condition of the bladder itself. The same general signs of chronic inflammation are seen in its mucosa as in other mucosæ and the discovery of such by the urethroscope indicates a cystoscopy.

Under cystoscopy are shown all the clinical, diagnostic and therapeutic data so that these need not be repeated here.

**Posterior Urethra.**—*Common Lesions.*—Within the prostatic urethra the following signs of chronic inflammation are seen and will be discussed in the order given: soft infiltrations, bullous edema, infected glands, gaping ducts, thick discharge from crypts and prostatic ducts, granulations, polypoid masses, exfoliations, ulcers, deformities and stricture.





FIG. 154



FIG. 155

FIGS. 154-161.—Urethroscopic fields of the male urethra. (Wiehe-Chemnitz.<sup>1</sup>)

FIG. 154.—Middle part of the pendulous normal urethra with strongly outlined bloodvessels and closure of the lumen at the center. Normal gloss of epithelium present.

FIG. 155.—Bulb of the urethra during recent inflammation; instead of the normal small folds there appear gross swellings or edema, absence of bloodvessels and of gloss of epithelium around the central lumen which is patent.



FIG. 156



FIG. 157

FIG. 156.—Middle of the pendulous urethra. On the surface of the mucosa extensive gross inflammatory changes are not visible; bloodvessels are apparent and gloss nearly normal but on withdrawing the tube a small drop of pus is expressed from the infiltrated cavity of a crypt of Morgagni. At the top of the figure is a patent but pus-free crypt. The central lumen is closed by small lobules somewhat as in Fig. 155, suggesting infiltration.

FIG. 157.—Soft infiltration in the posterior portion of the pendulous urethra, with succulent mucosa and irregular swelling; bloodvessels are imperfectly visible and gloss altered. In the upper part of the field is a cyst of a urethral follicle.

<sup>1</sup> Wiehe-Chemnitz in Oberlaender-Kollman, *Die Chronische Gonorrhoe der männlichen Harnröhre*, 2d ed.



FIG. 158



FIG. 159

FIG. 158.—Middle part of the pendulous urethra healed after prolonged mechanical treatment. As final remnant of the cured gonococcal infection on the right is seen a white area (soft scar of Oberlaender) and a definite decrease in folds. The central lumen consists of a slit with four large folds leading into it. A crypt of Morgagni is patent in the upper part of the field. Bloodvessels and gloss are less distinct than normal.

FIG. 159.—Bulb of the urethra in a dense stricture. A dirty gray discoloration of the mucous membrane with only few bloodvessels and no gloss is apparent. The lumen is a transverse slit with deep large furrows leading into it.



FIG. 160



FIG. 161

FIG. 160.—Middle of the pendulous urethra. A very dense stricture holds the lumen of the canal open as a rigid tube with a tunnel-like chink. As the result of progressive dilatation new bloodvessels are seen in the process of formation. Above on the left is a patent crypt of Morgagni. Normal gloss of the epithelium is replaced by pallor of the scar.

FIG. 161.—Entrance into a stricture in the pendulous urethra. The central figure is seen as a transverse slit without obvious folds and the mucosa is altered as to gloss and bloodvessels.





FIG. 162.—Floor of the sphincter and supramontane urethra. (Buerger.<sup>1</sup>)



FIG. 163.—Normal type of colliculus (verumontanum), with large utricle. (Buerger.)



FIG. 164.—Normal colliculus, show three vertical slits, the utricle in center and the ejaculatory ducts either side. (Buerger.)



FIG. 165.—Normal colliculus, showing the utricle, the ejaculatory ducts, the declivity above, and the posterior frenula. (Buerger.)



FIG. 166.—Junction of the bulb and pendulous urethra; the bulb is properly illuminated. (Buerger.)



FIG. 167.—Right margin of the sphincter. (Buerger.)



FIG. 168.—Cystic changes at the margin of the sphincter. (Buerger.)

<sup>1</sup> Cabot's Modern Urology, 1918, pp. 98-103.

*Soft Infiltrations.*—Chiefly along the roof, less at the sides and rarely on the floor of the posterior urethra, are seen grape-like swellings, often called bullous edema. They are large or small, few or many, scattered and discrete, grouped and confluent, usually nonvascular and pale, occasionally vascular and red, soft, easily hemorrhagic and disappear



FIG. 169.—Cystic changes in the verumontanum. (Buerger.)



FIG. 170.—Atrophy of the verumontanum with crater formation due to rupture of an abscess. (Buerger.)



FIG. 171.—A deep scar and large crypt in the right sulcus lateralis and distortion of the colliculus. (Buerger.)



FIG. 172.—Floor of the sphincter in so-called lateral lobe hypertrophy (prostatic adenoma). (Buerger.)



FIG. 173.—Lateral lobe hypertrophy in the supramontane region viewed with the cysto-urethroscope. (Buerger.)



FIG. 174.—Lateral lobe hypertrophy: view just above the verumontanum; the latter is small. (Buerger.)

on pricking with knife or other instrument. They do not seem to be followed by important sequels and may be regarded as a low-grade edema expressive of chronic inflammation. They are probably lesions greatly benefited by the pressure of sounds and dilators.

*Treatment.*—Soft infiltrations often terminate under good management and treatment without urethroscopic methods other than that

for final diagnosis. The inflammatory character of the focus indicates sedation rather than stimulation, hence urethroscopic activity is not advisable. Dilatation with any instrument should be carefully undertaken and flexible sounds are preferred. No reaction should follow such steps. If indolent granulations and inflammation characterize the annexa of the infiltration they may be regarded as more or less the cause of it and must be cured before the infiltration will be relieved. Cure is fully discussed in the clinical sections.

*Bullous Edema.*—The urethroscope is not a satisfactory instrument for treating bullous edema because it is too irritable and inflammatory, so that much the same principles apply as for soft infiltration. The cause of the edema should be sought and treated in order to benefit the edema. Puncture of the cystlike masses and stripping them with the weak Oudin current or with mild chemical caustics have little merit, as in most cases the lesions are repeated in a higher degree. Underlying profound inflammation as seen in prostatitis and tuberculosis must be controlled in order to influence the bullæ. This lesion is, therefore, rather a symptom than a distinct entity. Gentle dilatation with sounds or expanding dilators will often help, combined with relief of the underlying cause. Cure is fully detailed in the clinical sections.

*Chronic Infected Glands and Gaping Ducts.*—The glands are the mucous follicles scattered over the roof of the prostatic urethra and may be scattered and few or grouped and numerous. Dependent on the activity of the process they may be red points with a zone of redness, or open pockets filled with or discharging globules of mucus and have definite depth. They may project above the surface similar to acne pimples. As elsewhere in the canal such glands are simple or compound and become of great importance in maintaining infection. While present in the prostatic urethra they are much less numerous than in the anterior urethra, where they are a very common lesion.

The gaping ducts are open mouths of ducts and chiefly those of the prostatic acini. All degrees of visibility are seen from just apparent to 8 to 10 F in diameter. Where abscess of an acinus has occurred a wide-open cavity may appear. The largest ducts are in the prostatic sinuses. The edges are smooth or ragged, pale or red; the contents are fluid or form pus, all according to the activity of the process. The depth as a rule is not great but definitely more than that of mucous follicles. These are permanent lesions and do not recover except by operative obliteration.

*Treatment.*—The indication is to eradicate the pocket and sinus formed by the gland and its duct. For this purpose the urethroscope is extremely valuable in the anterior and the posterior urethra by means of applications, incisions and cauterizations.

In general, applications are of little value except after the other two methods have been applied, because the caustics strong enough to destroy the focus flood the mucosa of the annexa more than they penetrate the duct of the gland. This leads to unnecessary damage.



The incision technic requires exposure of the gland in the fenestrum of the urethroscope followed by local anesthesia with cocain or its derivatives and by hemostasis with adrenalin or a chemical styptic. Rather free stabbing or incision of the duct and gland to lay them open from the bottom is then done. Blood and pus are swabbed away and the wound cauterized with a chemical caustic, electrocautery or the high-frequency current of Oudin. The last two are much preferred because controlled in placing the points while cold and then in turning on the current limited by the rheostat in its activity to meet the requirement of the disease.

The direct cauterization without cutting is best performed by the current of Oudin, whose strength is made coagulating for the severe cases and desiccating for the milder cases and never incinerating for any case. The soap test described on page 501 should be employed as the measure of current. The electric wire with its tip projecting a little beyond the insulation is applied to the duct and if possible penetrates it, and then the current is turned on and off for brief intervals several times until mild coagulation is seen. If well done a superficial scar is produced, invisible as soon as the reaction disappears. Such scar does not involve the submucosa or deform the canal. In Skene's glands the urethroscope is usually unnecessary. Any of the foregoing methods might be applied to them but would be more difficult than the technic already given for the surgical treatment of these glands under complications in the female.

In the *aftertreatment* granulations and similar lesions located near the diseased glands are treated. A hand injection of any astringent, such as argyrol, 5 to 10 per cent., or the Ultzmann solution, will abate any tendency to catarrhal sequels. The little slough is usually cast in from five to seven days and then its base must be touched with nitrate of silver, 10 per cent. to 25 per cent., without flooding the annexa.

Cure is clearly outlined in the clinical paragraphs on this subject.

*Thick Discharge.*—Pus is seen on the surface and in the crypts and acini. It may be removed by gentle massage or sometimes with the platinum loop from the glands and ducts and mopped from the surface with swabs. It is often adherent and wipes or washes away with real difficulty, revealing beneath exfoliation, ulceration, diseased glands and granulations. It contains organisms, epithelial cells and detritus, but is sometimes sterile to smear and culture; it may be regarded as a temporary lesion and disappears when its source is removed.

*Treatment.*—The two origins of thick discharge must be respected, which are endourethral, proceeding from the glands, and exourethral, developing in the prostate and the glands of Cowper. The latter has special treatment not concerned with urethroscopy, which has been detailed under gonococcal lesions of the prostate and glands of Cowper on page 113. The urethroscope will locate the endourethral cases in lesions such as diseased glands, stricture, granulations, ulcers and neoplasms and until such foci are relieved much of the discharge will

continue. In the after-treatment, however, of the foci urethroscopy with special applications will decrease and finally will relieve the exudate. Cure is fully noted in the clinical sections of this book.

*Granulations.*—When the chronic disease has broken the surface of the mucosa hypertrophy of the granulations in the healing process may occur. Ordinary exuberant granulations are common; if excessive a granuloma occurs and if still further developed a polypoid tendency or a polypus is seen. All are therefore a development of the healing process in granulations. They are apt to appear in the folds of the mucosa, and in this respect resemble eczema in its predilection for the folds and angles of the skin. They therefore are chiefly in the prostatic sinuses, around the base of the colliculus where it presses into the roof of the canal. They appear as rough or fine outgrowths or very uneven projections of the surface or even sessile polypoid masses. Being highly vascular they bleed easily and obstinately. The minor degrees are temporary lesions and easily cured with treatment, but the major degrees are much more severe and may lead to stricture.

*Treatment.*—The urethroscope reaches these lesions better than any other method. Applications are made as on similar conditions on the surface of the body. There must be superficial reduction in most cases and occasionally relatively deep destruction, but always with caution. The curette is good if it may be readily and exactly applied, but in the author's opinion several applications of the weak current of Oudin in the desiccating strength are the best treatment and may be repeated every five to seven or ten days as needed. Around such granulations are nearly always found unhealthy glands which must be treated in the manner already noted, after the granulations have been removed. Cure is described in the clinical sections of this volume.

*Polypoid Masses.*—These are the later stages of granuloma and are sometimes wrongly called papillomata. True papilloma of the urethra is a very rare occurrence but polypi are very common and have their origin in unhealthy granulations. They are usually sessile, much less commonly pedunculated and apt to appear on or about the colliculus, often caudad but less frequently cephalad to it. They may be as large or larger than the colliculus and difficult to distinguish from it. Their origin seems to be irritation from the pus and mucopus more or less retained in the folds of the canal and stimulating exfoliations to such outgrowths. Such pus is commonly not sterile although it may not contain the gonococcus. The lesions are permanent unless relieved by treatment.

*Treatment.*—Again the urethroscope is the most certain and ready means of treatment. Liquid caustics are almost useless because they reach healthy tissue near the growths and do harm. Many of the polypi may be removed with snare or scissors, but the afterbleeding is a disadvantage. In the author's experience the high-frequency current of Oudin to the coagulating degree, as shown by the soap test described on page 501, is the most exact and satisfactory means. One or a few applications about one week apart are commonly enough. The

irect d'Arsonval current is favored by some authorities and applied a strength of 150 to 300 milliampères. Any unhealthy glands or mucosa around the base must be treated after the growth is removed and the wound healed. Cure may be dismissed with the clinical details previously given.

*Exfoliations.*—Denuded spots, patches and zones due to the activity of the acute process and continued by the chronic disease are shown by the absence of luster, roughness of base and overhanging edges. Such edges are often free and wave in the irrigating fluid. Ulceration is a later stage. Exfoliations are usually temporary and heal under proper treatment, but they often go on to ulceration.

*Treatment.*—The loss of superficial epithelia is the early stage of ulcer without infection and is readily seen with the urethroscope. Mild applications on swabs of silver nitrate, from 1 per cent. to 10 per cent., mixture of iodine and even 95 per cent. alcohol—all without flooding—are readily curative. The aftertreatment may require attention to diseased glands which may be in the same portion of the canal. Cure is discussed in the clinical sections.

*Ulcers.*—Open sores are the later progress of exfoliation by deepening and extending the process. Superficial or deep abscesses rupture and leave excavated ulcers. The picture is a sore of various irritability, superficial or deep, large or small, and with edges undermined and ragged and base rough and raw. Pus may cling to its surface or extrude from its cavity. Bleeding often follows removal of the exudate with swabs, instruments or water. In the termination the ulcers heal, causing various deformities which twist the lumen out of size and shape, but in the prostatic urethra rarely close the canal because this segment is normally the largest and supported by the firm substance of the prostate.

*Treatment.*—Open sores of the mucosa may be irritated and extended by passing the urethroscope, and hence the need of added gentleness, anesthesia and styptics. According to their condition the treatment is exactly like that of granulations but more energetic. Liquid caustics must be exactly applied and not flooded on the mucosa and the slough of such reductions may be removed with the curette gently if it is not shed in about a week. As a rule it is better not to curette them. The writer believes that the most exact results follow the use of the current of Oudin in the desiccating or coagulating strengths every seven or ten days according to reaction. Deep destruction is rarely necessary. The aftertreatment regards the chronic inflammation and the diseased glands surrounding the ulcer and furnishing other evidence of profound infection. Cure is fully detailed in the clinical sections.

*Deformities.*—As already indicated, these are the sequels of ulceration and ruptured abscess in their healing processes. They likewise arise from hard infiltrations which in the anterior urethra would lead to closure. These deformities are really strictures in the sense that they are deep and extensive alterations in the walls of the canal, depriving of elasticity, normal moisture and full lumen, although the lumen itself is not closed.



*Treatment.*—Great changes in the form, caliber or course of the urethra are hardly amenable to the urethroscope beyond the important detail of exact diagnosis. Their repair belongs to plastic surgery in external and internal urethrotomy. Most of the cases are due to stricture. Cure is outlined in the clinical paragraphs.

*Strictures.*—These are hardened, dry areas in the mucosa, which very rarely extend to occlusion of the passage. Filiform strictures are rarely seen in the prostatic urethra on account of its anatomical size and arrangement. The pathogenesis of stricture is fully discussed under this Complication of Urethritis on page 336 and the urethroscopic picture is described under Anterior Urethra on page 641, where the lesion is more typical.

*Treatment.*—As already elucidated, the urethroscopic diagnosis reveals the condition, position, type and lumen of the infiltration. It is well to decongest deeply the entire area with adrenalin and cocain or its derivatives. The lumen is in this manner displayed by removing the edema of inflammation and especially that of faulty attempts at instrumentation. The filiform whalebone guide may then be passed under the eye and then dilating sounds employed, by choice the author's irrigating type of instrument, because the bladder may be filled with fluid which flushes the urethra from end to end. If urethrotomy is selected the urethroscope may show the best part of the canal for the division of the infiltration whose greatest density may be at any point and usually farthest from the position of the lumen—dorsal, lateral or ventral. In the aftertreatment the granulations and chronic urethritis proximal to the stricture must be relieved. They have been described in the paragraphs on stricture of Chapter VI on pages 336 to 343.

*False Passage.*—The site, course, extent and number of the false passages are determined by the urethroscope, and most important of all their relation to the stricture. After this has been proved the urethroscope is a guide for the operative treatment of the stricture itself and then of the false passage. Cure of both stricture and false passage is fully noted in the clinical section in Chapter VII.

*Recapitulation.*—The lesions of the prostatic urethra are usually the most important for the urethroscopist. According to the location and penetration of the process the lesions of the prostatic urethra seen in the urethroscope may be summed up as follows: The whole cavity at any point of the surface may show active or passive hyperemia or pallor, thickening, but rarely extending to occluding stricture, exfoliation, ulceration and edema. Copious exudate may bathe its walls as fluid, semifluid or formed pus.

The glands are enlarged, prominent and discharging, or enlarged, occluded, cystic or atrophied. Their ducts are represented by puckered cicatricial spots.

The colliculus may be reddened or pale, hypertrophied or atrophied, hemorrhagic or nearly dry, rough or smooth, edematous and covered with granulations or polypoid growths.

The utriculus may be enlarged and deformed and filled with adherent exudate.

The prostatic ducts and ejaculatory ducts may show a large variety of changes about their lips, such as eversion, inversion, closure, patency and altered secretion. The ejaculatory ducts correspond in their condition with that of the utriculus and colliculus, as a rule.

**Membranous Urethra.**—*Chief Lesions.*—The urethroscopic picture changes from the general complex anatomy of the posterior urethra to the more simple contents of the anterior urethra. The glands are few and not important. The processes are the same in kind as in other mucous glands, but less important because so few and scattered. Infiltration of the mucosa is the most important and follows the kind and degree seen in the anterior urethra and especially in the bulb of the same individual. It is for this cause that stricture of the bulbomembranous juncture becomes important. The association of the membranous urethra with the pathology of the bulb is the reason why the latter is so difficult to outline in the urethroscope. Except stricture, the lesions of the membranous urethra are not severe and under appropriate treatment are often not permanent.

**Anterior Urethra.**—*Common Lesions.*—All the foci of disease are the same as in the prostatic urethra excepting those of the special anatomical features of this portion of the canal, such as the colliculus with its utriculus and ejaculatory ducts, the prostatic sinuses with their prostatic ducts and the crista urethræ. Conspicuous in the anterior urethra are affections of the lacunæ of Morgagni, glands of Littre and soft and hard infiltration. All the former have been thoroughly discussed for the posterior urethra and the general pathologic features in urethroscopy which leaves hard infiltration or stricture for attention here.

**Stricture.**—The author's<sup>1</sup> classification of stricture according to diameter, as tight from filiform to 10 F., as close from 10 to 20 F., and as open from 20 F. and larger is convenient but arbitrary. It is less objectionable than that of Oberlaender,<sup>2</sup> who seeks to limit stricture to those changes in the canal which refuse 23 F. instrument. The urethroscopic picture of stricture much more nearly corresponds with the description of Finger<sup>3</sup> and shows glandular disease, periglandular extension, submucous involvement, cellular penetration and varying loss of elasticity and presence of deformity of the canal. It may not obstruct the lumen greatly but it means destruction and atrophy of the mucosa as a whole at that point or zone of the canal.

As shown under stenosis as a complication of urethritis on page 334, such lesions may occur at any point of the canal in length or circumference and in depth or extension. The urethroscopic picture always supplements and proves the diagnosis as found by other instruments and methods, such as bougie-à-boule, steel or flexible sounds, urethral palpation, rectal examination and the seven-glass test of the author.

The color is pale, bloodless and that of dense scar-tissue. The vessels

<sup>1</sup> Loc. cit.

<sup>2</sup> In Oberlaender and Kollmann, Loc. cit., p. 467 et seq.

<sup>3</sup> Blennorrhæ der Sexorgane, v, 1901.

are few or absent and no shift of the instrument or change in the dilating air or fluid makes them appear. Edema is often cephalad to the node and is never seen on its surface through absence of full vascular supply. Inflamed strictures show edema in all annexa. Elasticity is greatly reduced or absent and this forms the real obstruction to the instrument. It is proved by absence of resiliency to the air or fluid and of softness to the touch. The crypts are usually absent entirely or a few large atrophic and dry mouths may show in the stricture surface. Dilatation, granulation and discharge are most abundant in the urethra for an inch or more cephalad to the lesion.

The diagnostic advantages of the urethroscope are the recognition of location, extent and variety of stricture, the irregularities and peculiarities of its lumen, the association of other lesions, such as chronic urethritis and the proximal dilatation of the canal with granulomata, ulcerations and false passages.

*False Passage.*—The general clinical factors of this lesion are considered as a part of stricture in the Complications of Urethritis on page 409. With the urethroscope the diagnosis is often rendered absolute in a way that fails by other means. Its location is commonly away from the maximum density of the stricture node and often in relatively healthy or chronically inflamed urethral wall caudad to it. Its nature is recognized as that of a tear varying according to its age. Its edges are ragged and irregular, hemorrhagic or not, so that touch with the urethroscope or other instrument provokes much or little bleeding. Occasionally with the operation urethroscope of Buerger or McCarthy the passage may be entered with a ureteral catheter or the air dilatation urethroscope of Mark or Hayden. In contrast the stricture orifice is in the substance of the stenosis and is usually a puckered dry opening if visible. In some strictures it is either buried in proximal edema or very difficult to see, because most cases of false passage have been repeatedly traumatized by efforts to pass the obstruction and therefore show much edema caudad to the stricture.

The choice of urethroscope in diagnosing stricture depends on the lumen of the canal. An infiltration which passes a 24 F. instrument is in the author's opinion best studied with a water-irrigating, lateral fenestrum, magnifying urethroscope, such as that of Buerger or McCarthy. If the stricture is close (10 to 20 F.), or tight (10 F. and smaller), then the air dilatation, terminal fenestrum, magnifying urethroscope of Mark or Hayden becomes necessary. There is no question that in these cases the terminal fenestrum instruments give a beautiful picture of the altered wall as it recedes to form an atypical cone. These facts emphasize the author's opinion, as already stated, that a urologist should have both types of modern instrument.

The use of air in stricture cases with false passage is not without danger as pointed out by Fenwick,<sup>1</sup> who had the air infiltrate the perineum during the examination without disastrous results, although painful to the patient.

<sup>1</sup> Australasian Med. Gaz., 1906, xxv, 508.

## B. NONGONOCOCCAL LESIONS IN URETHRITIS.

**Significance.**—Many of the nongonococcal manifestations are less important than the gonococcal only because they are much less frequent, but in themselves several are of grave meaning, of which tuberculosis is a familiar example.

**Varieties.**—The general classification includes anatomical abnormalities, special inflammations, new growths and foreign bodies. Under anatomical abnormalities are placed valves and diverticula. Special inflammations embrace catarrhal, suppurative, tuberculous, herpetic, chancrel, chancrous and cystic. New growths are benign which are amplified by papillomata, polypi, fibroses and varices or malignant which comprise chiefly carcinoma and sarcoma. Foreign bodies are calculi descending from the kidneys, ureters, bladder or prostate.

**Anatomical Abnormalities.**—**Valves.**—Valves are probably in nature an overdevelopment of the circular muscular bundles of the urethra or duplications and redundancies of the mucosa. Taylor<sup>1</sup> has made a study of the urethra and shown at least eleven normally present transverse muscular bands. Other valves are probably abnormally large or altered lacunæ of Morgagni creating folds in the mucosa.

In locations the valves may be seen at almost any point of the urethra, most commonly in the anterior portion. They may also be on any part of the canal, but the usual site is the roof, where the support of the corpora cavernosa makes the valve action more positive. Simple duplications of the mucosa are seen on the floor.

In size the valves vary from small to large with a tendency to definite dimensions so as to catch instruments in exploratory diagnosis and to obstruct the filiform guide or the ureteral catheter in urethroscopy to measure its depth. It is probable that the catching of the filiform guide in the dilatation of stricture is due to such valves. In a restricted sense they are not unlike the valves of Houston in the rectum. Their openings are usually directed cephalad and their openings caudad. This arrangement is rarely reversed.

The urethroscopic picture is that of a narrowed U or V according to the patency of the opening, which as stated is toward the observer in most cases. If uninfected the lips are clean and tense rather than flaccid. The depth varies from sufficient to catch the mere point of an instrument to 0.5 to 1.0 cm. The base is clean and may show one or more mucous crypts. If infected the lips are thick and ragged and the surface is granular and bathed with pus or mucopus which may be wiped away. External pressure on the urethra may extrude the formation. Such formations are definite in maldevelopment or pathology of the lacunæ, but much less so in the muscular valve or membranous reduplications.

The recognition of the valves is by exploration with the filiform or catheter or by alterations in appearance through water or air dilatation.

<sup>1</sup> Genito-urinary and Venereal Diseases, 3d ed., p. 203.

The easiest valves to investigate are those opening caudad, into which instruments and dilatation media will pass readily. Mark<sup>1</sup> reports a case in which a valve opened cephalad in the bulbous cul-de-sac in a young man, twenty-one years old. It was accompanied by slight dribbling and was recognized by air inflation so that "the air was refluxed back from the obstruction presented by the compressor and lifted up the valve, bringing it plainly into view and establishing the diagnosis beyond doubt. We should strongly suggest the use of air-inflation in the diagnosis of this variety of valvular formation, believing that it affords a more certain method of diagnosis."

The author has had one remarkable case of valve formation, dorsally placed, admitting a filiform for about 1 cm. having a large cavity and three or four crypts easily seen near its outlet, which faced caudad. The flap overlying the valve was cut through with the high-frequency current of Oudin which made the halves shrivel and permitted drainage of the exudate and cure of the case.

**Diverticula.**—In the urethra diverticulum is of two forms, either congenital and due to malformation or acquired and rising through the obstruction of stricture. In the opinion of the author the former is, strictly speaking, diverticulum and the latter sacculatation exactly as in the bladder. The true diverticulum is infantile in its occurrence and diagnosis and rests on clinical signs rather than on urethral exploration with the urethroscope or otherwise. Sacculations are common with all severe stricture cases, are easily detected through a urethroscopy caudad to a filiform stricture after the same has been dilated or divided. In some cases prior to relief of the stricture air or water may be gently forced through it and produce a bulging between the cutoff muscle and the proximal aspect of the node. Occasionally intelligent patients note it during urination and ask the cause. Chronic inflammation is more or less actively present everywhere in the pouch, whose walls come and go with the dilating medium—urine, water or air. The floor of the urethra is chiefly compromised because unsupported by the corpora cavernosa and thus the floor thins out to touch and view and becomes the common site of the sacculations. The lesion is essentially permanent but considerable restoration may follow proper relief and after-treatment of the stricture.

**Treatment.**—The anatomical malformations—the valves, diverticula and sacculations—are relieved by division with the knife or the Oudin current. The author's practice has been to divide the band with the current down the middle, so that two flaps are created which rapidly shrivel. The burned margins do not bleed and do not tend to unite as they would and often do after cutting. To obtain this result the burning must be carried from the free margin down to and through the base where it unites with the surface of the canal. Valves may be spread open and made tense by the air dilatation and then divided or sparked. Sacculations are important in their relation to stricture in the

<sup>1</sup> Cystoscopy and Urethroscopy, 1915, pp. 198 and 199.

imal mucosa where they must be sought and relieved. The after-treatment reduces the secondary reaction and cares for the follicles now present under cover of the valve or within the cavity of the urethra.

**Special Inflammations and Infections.—Varieties.**—Under the group of special inflammations of the urethra are found chiefly catarrhal, suppurative, herpetic, tuberculous, chancroidal, syphilitic and cystic inflammation, of which each deserves description of the urethroscopic findings. Each has been fully described in the clinical sections of this work.

**Catarrhal Urethritis.**—As already noted, the exciting cause of this condition is the *Micrococcus catarrhalis*, which must be recovered for the diagnosis, usually acting in a diathetic subject. The urethroscopic picture is similar to that seen in chronic gonococcal urethritis but very mild in degree and without serious complications or sequels. Chief among the lesions is an indolent hyperemia with mucous discharge rather long duration and resistant to treatment. The mucous crypts discharge mucus and mucopus but never pus and the urine is apt to show strings and clouds rather than shreds of exudate. The great value of the urethroscope is to secure specimens for culture from these crypts. The termination of the inflammation is in recovery without the numerous sequels and permanent lesions of gonococcal disease.

**Treatment.**—Urethroscopy may prove too violent for catarrhal inflammations and must be abandoned if unfavorable reaction ensues. In many cases, however, individual glands may be found and treated in the same manner but with more gentle means than those described for gonococcal glands. Catarrh about other lesions as already noted is one of the most frequent fields of treatment for this form of inflammation. Internal medication for the catarrhal tendency with tonics of the like must always be included. Cure is sufficiently described in the clinical portion of the text (page 73).

**Suppurative Urethritis.**—As shown in the clinical paragraphs on this subject the cause of nongonococcal suppuration within the urethra is one of the common pyogenic organisms. The commonest are the staphylococcus, staphylococcus and the *Bacillus coli*. The urethroscopic picture may duplicate all the clinical features, course and termination seen in gonococcal urethritis. The complications and termination are very analogous. The bacteriology rendered definite through the urethroscope is the sole diagnostic distinction.

**Treatment.**—Infection with the pyogenic organisms so closely duplicating the symptoms and sequels of that with the gonococcus likewise dictates the indications for treatment with the urethroscope. The latter is therefore referred to Gonococcal Urethritis (page 52) for the details of treatment and cure.

**Herpetic Urethritis.**—Cold sores within the urethra as elsewhere on the body are caused by an infection and are usually accompanied by the same lesion elsewhere, such as on the glans and prepuce. For this condition herpes of the urethra is not a primary but an associated lesion going with the same affection in other parts. It is not, exactly speak-



ing, secondary only in the sense that all other herpes is secondary. The urethroscopic picture is that of an external herpes passing through the regular stages of an inflamed tender papule, later surmounted by a vesicle which bursts, leaving a small ulcer. It has little significance except the danger of cross infection and the great pain during its acme, greatly increased by urination. The peculiar angry base, superficial ulcer and the absence of the bacillus of Ducrey and of the *Treponema pallidum* distinguish it from chancroid and chancre. Herpes terminates without scar or other lesion unless it suffers mixed infections and thereafter becomes a totally different pathologic entity.

**Treatment.**—The urethroscope is applied only in the chronic period of the lesion after the anger of the invasion has ceased and treatment through the instrument must meet the indications of sterilizing, drying and healing. Endourethral lesions are very difficult to reach and probably the mild desiccating spark of the high-frequency current of Oudin, as shown in the soap test on p. 501, is the best application. It should be given very briefly and for only superficial reaction. One sitting is usually sufficient. Aftertreatment is that of a very mild hand injection such as argyrol, 3 per cent. to 10 per cent. Cure is well dismissed with the details given in the clinical text.

**Tuberculosis.**—The disease is regarded as primary or secondary in the urethra, but it is very doubtful whether primary tuberculosis in the strict sense ever occurs in the urethra to the exclusion of foci elsewhere. In animal experimentation the inoculation of the disease in male rabbits has been attended with success in the hands of Baumgarten,<sup>1</sup> quoted by Ahrens.<sup>2</sup> Kraske<sup>3</sup> claims that it does occur, while Hogge<sup>4</sup> states positively that there is no record of proved primary tuberculous urethral lesions.

In secondary tuberculosis is presented a familiar experience. Penile lesions such as those of the glans and prepuce may extend into the canal by continuity and others reach the urethra by perforation, such as the cases of Kraske<sup>5</sup> and Hartmann.<sup>6</sup> By far the most important secondary cases are those in which the primary lesions are in the kidney, bladder, prostate, seminal vesicles, vasa deferentia or testicles, from which they reach the urethra in the urinary or seminal stream or through the blood or lymphatic vessels.

The concurrence varies with age, sex and general epidemiology. As to age the third decade of life during the great activities of the sexual system is the most common. As to sex, males are much more often afflicted than females, according to Ahrens,<sup>7</sup> who notes only four reports in females. This fact may be due to the short canal and the

<sup>1</sup> Quoted by Ahrens, but not in the library of the New York Academy of Medicine.

<sup>2</sup> Beiträge zur klin. Chir., 1891-92, viii, 312.

<sup>3</sup> Beiträge z. pathol. Anat., 1891, x, 204.

<sup>4</sup> Ann. des Malad. des Org. Gen.-urin., 1901, xix, 1486.

<sup>5</sup> Centralbl. f. Chir., 1888, xv, 889.

<sup>6</sup> Bull. et Mém. Soc. de Chirurgie de Paris, 1906, xxxii, 974, and Trav. de Chir. Anatomique, p. 278.

<sup>7</sup> Beitr. zur klin. Chir., viii, 312.

sence of neighboring organs, such as the prostate, vesicles and testicles, which are so often invaded. Statistics vary from a fraction of 1 per cent. to 4 per cent., which makes the disease relatively rare even among tuberculous patients. Halle and Metz<sup>1</sup> found it in 1 out of 160 patients or 0.75 of 1 per cent. Ahrens<sup>2</sup> collected 433 cases from reports of Steinthal, Krzywicki, Pavel and others and found only 8 urethral lesions, or about 4 per cent.

As to site, the posterior urethra is most commonly invaded probably through the influence of the sexual glands—prostate and testicles with the seminal vesicles and funiculi. These facts still further tend to prove the secondary tendency of the disease, so that one must respect foci in these organs and in the glands of Cowper.

The urethral picture is much the same as that of tubercles or tuberculous ulcers in the bladder. The tubercles may give few or no symptoms and will not often be discovered unless systematic investigation with the urethroscope is adopted. Ulcers, therefore, predominate in the reports. The tubercles appear as rounded yellow or white spots centered in hyperemic zones of infiltration and edema, as constant elements. The tubercle itself is the densest point of the infiltration and ready to necrose from cellular proliferation. Their size is usually small but may be large. The exact image and magnification of the lateral fenestrum urethroscope permit easy detection of them as a rule. Greater difficulty is found in the terminal fenestrum instrument. The ulceration is a still later condensation resulting in devascularization and centric death. The floor is ragged and uneven, the edges unched and elevated, closely resembling a clean chancre. Later by extension and mixed infection the destructive ulcer is seen resembling phagedenic chancre with marked infiltration and undermining. Kidd<sup>3</sup> believes that extension forward is accompanied by change in the tuberculous characteristics. It is probable that the urinary and sexual streams provide for extension caudad more rapidly than the destructive action of the lesion carries it toward the bladder. In the anterior urethra the bulb is the most common site exactly as it invites gonococcal chronic lesions.

In the prostatic urethra the lesions are always associated with renal, ureteral, vesical, prostatic, testicular, vesicular or funicular deposits. From these points they extend downward and form foci usually in the prostatic fossettes or upon the colliculus. The author has had a beautiful example of the process in a man having tuberculosis in the right kidney, in the bladder about the right ureter and in the right testicle and vesicle. The bacilli were numerous in the urine. Posterior urethroscopy revealed tubercles around the colliculus and in both prostatic sinuses. Ulceration had not yet occurred.

In the diagnosis, the discovery of antecedent foci is all-important. The simple tubercle is surrounded by a zone of redness and very soon central ulceration appears. The subsequent condition is typical. In

<sup>1</sup> *Ann. des Mal. des Org. Gen.-urin.*, 1903, xxi, 481.

<sup>2</sup> *Loc. cit.*

<sup>3</sup> *Trans. Path. Soc.*, vol. lxxxix, p. 185.

the early stages it differs from chancre in being located almost always in the deep urethra and rarely around the meatus, whereas chancre is never in the deep urethra but always in the first few centimeters of the canal, if internal at all. The presence of primary tuberculous lesions establishes the difference. Deeper ulcerations more closely resemble the primary sore of syphilis except that the latter extends backward toward the bladder, whereas the former eats its way from the bladder toward the outlet. Bacilli of tuberculosis or the *Treponemata pallida* if discovered are the final proof. Epithelioma is usually meatal, occurs in the later decades of life and has the characteristic clinical findings of lymphatic involvement. The cancer may ulcerate into the urethra from adjoining organs, especially in the female.

The value of urethroscopy in urethral tuberculosis is that it not only confirms a possible diagnosis but also indicates operative prognosis. Like cystoscopy in a suspected case it should never be omitted, and also like cystoscopy does not possess material, direct dangers for the patient.

*Treatment.*—The presence of the tubercle bacillus makes urethroscopy a possible source of danger through exciting its activities. It is essential, however, for exact diagnosis and thus correlates with the cystoscope in this aspect of treatment. As shown in the previous paragraphs on this subject it will also indicate prognosis and the results of operation. It is probable that relief and removal of the primary focus, as in the upper urinary tract or the sexual glands combined with body building and open-air life will relieve the urethral foci far better than urethroscopic applications. It is these elements of aftertreatment that are essential.

**Chancroidal Urethritis.**—As fully specified under chancroidal lesions as part of nongonococcal urethritis in Chapter II, the clinical features will need no repetition here. Like tuberculosis its occurrence is by continuity of surface or by perforation, during the age of greatest sexual activity and in males more than in females. The common site is the anterior urethra from meatal extension. It is very rarely literally endourethral and primary. It may occupy any point of the periphery or the entire periphery of the canal and may extend a considerable distance toward the bladder.

The *diagnosis* should be made without the urethroscope because the lesion is acute in its nature and the instrument causes pain and trauma and may transfer the disease to deeper parts. The chancroid is auto-inoculable. The urethroscopic picture is like that of the naked eye, slightly modified by the special illumination and restricted field. The floor is mouse-eaten, sloughy, grayish to red, and occasionally hemorrhagic, and the edges are always undermined and movable with an instrument such as a filiform or probe. A zone of acute redness and infiltration is about the sore and the lymphatics are painful and involved early. The exudate contains blood, pus and detritus and the bacillus of Ducrey, whose presence distinguishes the lesion from chancre and tuberculosis.

**Treatment.**—Infection of the urethra with the bacillus of Ducrey is fortunately chiefly at the meatus where it may be reached without the urethroscope. If within the canal care must be taken not to pass beyond the lesion and infect a new focus. Sterilization and removal of the slough after cauterization followed by stimulation of the granulations to healthy healing are the indications and the means have been described in the treatment of chancroid as a form of nongonococcal urethritis in the clinical chapters of this work. Great care must be exercised not to damage the annexa and thus extend the disease to new foci during attempts at relieving the primary sore. The aftertreatment involved with the urethritis of local character often associated with the chancroid. Gentle measures as recommended for catarrhal urethritis are required. Cure is fittingly discussed in the clinical pages.

**Syphilitic Urethritis.**—The full picture of syphilis of the urethra is given in the clinical paragraphs on page 37 so that no rehearsal here is needed. The forms are primary as the chancre and secondary as the mucous patch.

In the primary stage the chancres are typical or mixed. Either form may be more common in occurrence than is supposed because it causes few symptoms. The initial lesion through its enlargement, pain and obstruction is the more often noted by the patient and has as its site the meatus most commonly and just like the chancroids, it is directed cephalad to the fossa navicularis. Keyes<sup>1</sup> has reported a chancre about 1½ inches within the canal. The size is large or small, occupying a limited or great portion of the circumference and extent of the channel during the sexual age and chiefly in the male. Relatively this manifestation is very rare.

The *diagnosis*, like that of chancroid, is best made without the urethroscope because of the pain and injury of the part. The forms of chancre described by Taylor<sup>2</sup> should be borne in mind, otherwise confusion may arise. The urethroscopic picture is an ulcer with a smooth, glossy floor, clean-cut indurated edges with slight eversion but no undermining, rather regular outline and serous exudate. Pus and blood may be present. The *Treponema pallidum* is in the discharge and the substance of the sore. The lymphatics are late and the skin and its appendages still later in their involvement. The mixed chancre early duplicates the chancroid, especially when the pyogenic infection temporarily overshadows the syphilitic element.

The differential diagnosis rests on the presence of spirochetes, the Wassermann blood test, and later on the secondaries of the skin. Tuberculosis differs from syphilis in usually having antecedent lesions somewhere in the body or the urogenital tract and numerous other tubercles or ulcerations. The bacilli may be in the urine or recovered from the sore, the tuberculin test may be positive and systemic emaciation and secondary anemia may be present. Cancer differs in having a much later age, in being rarely primary but usually secondary by

<sup>1</sup> Ann. Jour. Dermatol. and Syph., 1870, i, 37.

<sup>2</sup> Genito-urinary and Venereal Disease, Third Edition, p. 500.

contiguity from the glandular structures about the deep urethra. The prostate and bladder in men and the vagina and uterus in women are common sources. Infiltration beyond the lesions, fixation of the entire region and definite spread through the lymphatics may all be present very early. There is neither *Treponema pallidum*, Wassermann blood test nor secondary lesions in cancer.

In secondary syphilitic urethritis the form seen is the mucous patch. The flora of the urethra may provide for the frequent presence of these lesions. The writer doubts this supposition because of the rarity of symptoms and of the fact that if present the patches would persist for long time in so closed a canal. The female urethra is much more accessible and does not show patches in any material frequency. In any other mucosa the lesion is very mild in its manifestations and from the author's observation it has been seen only at the meatus in the male and around the vestibule and meatus in the female. Some observers claim to have seen severe symptoms occur in their presence notably Bassereau<sup>1</sup> and Bumstead.<sup>2</sup>

The urethroscopic picture is that of a silvery spot or spots, sodden, soft, prominent, rarely hemorrhagic or tender, identified with the surface so that it does not rub off. It is due to proliferation of the epithelium. The *Treponema pallidum* and the Wassermann blood test should be looked for. The lesions terminate under systemic treatment aided by local cleanliness, whose absence was manifest in the case of the author and filth was obviously one of the causes.

*Treatment.*—The chancre, like the chancroid, is usually meatal in its occurrence and rarely endourethral, but the mucous patch may occur within the urethra and require urethroscopic applications. Cleanliness of the surface and urethra through urinary antiseptics and frequent urination are the first indications. Violent irritation with caustics and overstimulation will make the chancre worse and often advance the patch. Systemic measures must never be omitted and always continue after the lesions have healed. Thus they are an important part of the aftertreatment combined with urinary antiseptics and diluents provided the urine is foul. Purification of such urine avoids the irritation so often seen as the basis of mucous lesions.

Bassereau's article has no case reports, but only an inference that urethral discharge during an outbreak of secondary syphilis might be due to mucous patches in the urethra. There is only one case of mucous patch in Bassereau's collection and that was at the meatus.

Bumstead also has no case reports but makes an indefinite statement which indeed may have been borrowed from Bassereau. Of course both these authors are far in advance of bacteriologic days. Cure is well detailed in the clinical section on page 304.

**Prostatic Utricular Cyst.**—Inasmuch as this lesion is caused by inflammation it should be considered under special inflammations in urethroscopy. The cause is occlusion of the opening of the utricle, retention

<sup>1</sup> *Traité des Affections de la Peau Symptomatique de la Syphilis*, Paris, 1852, p. 356.

<sup>2</sup> *The Pathology and Treatment of Venereal Diseases*, 1865, p. 545.



of its normal exudate and cystic development. It is a medical curiosity, truly congenital and hence infantile in its presence. It is very doubtful whether it is ever seen in the adult. The author has never discovered one. In Europe, Englisch<sup>1</sup> made a study of it among 70 autopsies of newborn infants and found five specimens. In this country Cabot<sup>2</sup> reports that it probably does not occur among adults and notes one autopsy case. Among adults the best report of a possible case is that of Klotz,<sup>3</sup> who is by no means positive of the diagnosis but whose description is strongly suggestive of the lesion. Klotz quotes Belfield in this paper.

The urethroscopic picture is like that of any other mucous membrane cyst but located in the colliculus. The color is bluish-white with marked translucency, elasticity and tension. An acquired case would show the signs of chronic urethritis in the deep urethra and atrophy of the colliculus might be expected.

Other instructive contributions are those of Springer<sup>4</sup> and Belfield.<sup>5</sup>

**Cysts of the Follicles.**—Occlusion of the mucous crypts is not uncommon and has the foregoing characteristics in themselves and in their annexa.

**Treatment.**—The recognition of these lesions is the most important and the urethroscope is the one means of certainty. The cysts may be punctured with the knife or stripped with the high-frequency current of Oudin or the d'Arsonval current, as already described. Thus cysts are dealt with in much the same way as infected glands with infiltrated ducts. Around the colliculus great precautions must be observed in order to avoid atrophy of that body and closure of the ejaculatory ducts. Again the aftertreatment must respect the associated catarrhal or suppurative conditions. Cure is clearly outlined in the clinical paragraphs on page 109.

**Filiform Strictures.**—Buerger<sup>6</sup> employs direct vision through his operation urethroscope shown in Figs. 175-177. The instrument has a terminal fenestrum, irrigation, direct vision telescope and ample instrument tube. The sizes range in even numbers from 22 to 28 French. The average is 24 French. The left-hand figure shows the large instrument tube in the sheath, which has a urethral and vesical obturator.

The technic requires the lithotomy or analogous posture. The urethroscope touches the stricture, the obturator is replaced by the telescope, the urethra is held or bandaged water-tight around the sheath, light turned on, irrigation started and the opening penetrated with a Phillip's or whalebone bougie directly under the eye. Thereafter dilatation is continued or internal urethrotomy performed as indicated. The advantages of this method are obvious.

**Neoplastic Urethritis.**—As elsewhere, the classes are malignant and benign. The site of the malignant tumors is rarely endourethral but

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<sup>3</sup> New York Med. Jour., January 26, 1895.

<sup>4</sup> Zeitschr. f. Heilkunde, 1898, xix, 459-474.

<sup>5</sup> Jour. Am. Med. Assn., 1894, xxii, 574.

<sup>6</sup> Surg., Gynec. and Obst., March, 1918, xxvi, No. 3, pp. 347-350.



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<sup>6</sup> *ourg., Gynec. and Obst.*, March, 1918, xxvi, No. 3, pp. 347-350.

along the canal more or less as a whole, as originally shown by Vajda,<sup>1</sup> who was the first to describe them in the deep portions of the canal. Universal involvements have been described by Oberlaender,<sup>2</sup> by Desquier<sup>3</sup> who employed the endoscope and autopsy findings, and Reboul<sup>4</sup> notes a case in a woman with diagnosis by inspection and vaginal touch. Vajda in his report collected cases from a number of other observers and since the work of these various authorities their descriptions have been fully corroborated. The author has frequently seen papillomata in the deep urethra, the bulbous urethra and the terminal portion of the penile urethra and, of course, in the bladder, but he never has seen the lesions scattered along the entire canal, including the bladder.

The urethroscopic picture is best obtained through a terminal fenestrum instrument because the inflation with the air projects the urethra beyond the instrument for a considerable distance before the edge of the tube damages the lesion. Thus the number, attachment and grouping of the papillomata may be seen with least difficulty by advancing the instrument from the meatus toward the bladder and inserting the obturator as required. The lateral fenestrum instrument has a tendency to tear the lesions away. The growths appear like ordinary venereal warts, are single or multiple, sessile or pedunculated, thick or thin, similar to a cock's-comb with shallow or deep separations. They are of a pale pink or whitish color, slightly hemorrhagic, superficially attached, tearing off and breaking easily and leaving a shallow, bleeding base. They are often surrounded with mucus or mucopus which their mechanical presence provokes and they are themselves moist and sodden. They do not terminate spontaneously but must be removed.

*Polypus.*—The pathology of these lesions must be accurately followed, as pointed out by Lewis and Mark<sup>5</sup> among recent American writers, who divide them properly into the fibrous and vascular forms. Among the fibrous type are fibromata, consisting of pure fibrous tissue, fibromyxomata, composed of mucous and fibrous tissue, and fibromyomata, comprising a mixture of fibrous and muscular elements. The vascular form contains caruncles seen chiefly in women. It is essential to exclude from the polypi both papillomata, as already described, and granulomata or exuberant granulations which are more or less allied to them.

*Fibrous Polypi.*—The fibrous elements of the growth are pure or mixed with mucous and muscular elements to form respectively the fibromata, fibromyxomata and fibromyomata. In occurrence they are all rare especially the pure fibrous polyps but the mixed types are considerably more common especially if exuberant granulations may be included in the growths. The most common endourethral form is the fibromyxoma because it contains so largely mucous membrane elements.

<sup>1</sup> Wien. med. Wehnschr., 1882, xxxii, 1098.

<sup>2</sup> Loc. cit.

<sup>3</sup> Soc. Belge de Chir., December 28, 1890.

<sup>4</sup> Assn. franc. d'urol., 1896, 1, 39.

<sup>5</sup> Loc. cit.

reas the exourethral type is the fibromyoma because its muscle substance is developed below the mucosa and crowds it into the lumen. The site is in the bulbous and posterior urethra, exactly where the villæ abound and where folds of the mucosa and muscularis are deep. Ark says in the work already cited: "We have observed postmortem use of multiple fibromata in the prostatic portion of the canal. In this case there were six distinct polypi scattered over the inferior wall inside of the prostatic urethra."

The urethroscopic picture is best obtained with the air inflation instrument for the same reasons as given for papillomata. The growths have a reddish or pale color according to the sclerosis and the condition of the mucosa as it lies over the rounded rather smooth form. The attachment is pedunculated in the fibromata and fibromyxomata but variable for the fibromyoma. The annexa almost always show the presence or sequels of chronic inflammation and the lesions have no involution unless removed.

*Caruncular Polypi.*—The female is almost solely the victim of this lesion, which is described under urethroscopy in the female on page 66. The few reports of this lesion in males are confined to the spongy urethra and meatus. Inasmuch as one theory of these lesions is that they consist of erectile tissue occurring in woman through development where she should have none, it is difficult to understand how the true caruncle can appear in men exactly where erectile tissue is abundant and normal.

*Varicosities.*—Groups of vessels varicose and similar to nevi are common in the female urethra, where they are described, but very unusual in the male. Only two well-established cases have appeared in English literature. These are the reports of Klotz<sup>1</sup> and Young, cited by Fowler.<sup>2</sup> Full quotation is warranted in each instance.

*Case of Klotz:* "The protruding portion of the mucous membrane was found to be of a smooth surface and a dark bluish color, of the shape and size of a coffee bean, sharply defined at the base from the pink surrounding portions. The tumor was soft and easily yielded to the pressure of the tube, although on introduction it seemed to offer slight resistance. On close inspection within the tumor a number of separate cords, separated by yellowish-white lines resembling the rings of a coil, could be distinguished, apparently representing dilated bloodvessels, and imparting to the whole mass the character of a cavernous angioma."

*Case of Young:* "Urethroscopic examination by Dr. Young. No. 26. A tube was passed into the prostatic urethra, but it was impossible to introduce it as far as the verumontanum. The anterior portion of the prostatic urethra which was examined showed nothing particularly abnormal. The membranous urethra was also about normal. As soon as the bulbous urethra was reached, in drawing the urethroscope out, the picture was at once remarkably abnormal. Several large,

<sup>1</sup> Loc. cit.

<sup>2</sup> Johns Hopkins Hospital Report, xiii, 91.

deep red, irregular masses projected into the lumen, and between them were depressions of a dull gray color which suggested ulceration or old scars, but were probably not. This condition was present in the entire anterior urethra. As the instrument was drawn slowly out, a succession of irregular, rounded, deep red masses projected over the end of the endoscope; these were apparently covered by healthy mucous membrane, and between them were irregular depressions of grayish color, supposed at first to be ulcers, but no exudation could be obtained from them, and probing did not cause any hemorrhage, so that it was evident that they were not ulcers. The rounded deep masses which were scattered over the mucous membrane were evidently dilated bloodvessels. There were no ulcerations to be seen and no ruptured vessels or definite points of active hemorrhage, though blood constantly appeared in the endoscopic field.

*Treatment*—The important manifestations are papilloma, polyp, caruncle and varix. The urethroscope records exact diagnosis and offers removal or destruction with the snare, electrocautery, high-frequency current of Oudin in the desiccating or coagulating strength as shown in the soap test noted on p. 501, or the d'Arsonval current as described on p. 501. The electrotherapeutics are the best and treatments are repeated only after the reaction of each has disappeared or nearly disappeared. The aftertreatment comes in when the growth is entirely gone and the mucosa is closing over its attachment. Mild stimulation of this point may be required and is best given through the urethroscope alternating with instillations and injections according to circumstances. Inspection of the urethra at long and regular intervals to determine any tendency to relapse of the growth is a very important detail of the aftercare. Cure will in the pathologic sense mean removal of the growth so that no return occurs, but the portion of the mucosa involved is, of course, destroyed, usually without any inconvenience to the patient. Symptomatic cure adds the absence of such post-operative sequels and also the relief of secondary catarrh or other discharge.

**Malignant Neoplasms.**—Under this classification are included only carcinoma and sarcoma of the urethra.

*Carcinoma.*—The forms are primary and secondary as in all other new growths. Secondary cancer of the urethra ulcerating into the canal from its glandular and visceral annexa is by no means uncommon in both sexes, as already stated. In the male the usual origin is the prostate and in the female the vagina and uterus, and in both sexes the bladder. The primary cancer of the urethra is very uncommon when compared with carcinoma in general and with other urethral disease. Its actual frequency, according to well-established cases, is 27 cases in the male and 36 in the female on the authority of such recent researches as those of Hall<sup>1</sup> and Lecène and Prat.<sup>2</sup> This list includes those of absolutely fixed diagnosis and others could be added

<sup>1</sup> Ann. Surg., March, 1904, xxxix, 375.

<sup>2</sup> Hartmann's Travaux de Chirurgie Anatomique-Clinique, 1904, p. 278.

which it is doubtful. The majority were squamous-celled cancer, especially when associated with chronic inflammation in the annexa of stricture. The site is chiefly in the bulbous urethra, where folds and chronic inflammation are common and where the most severe types of anterior stricture are encountered. Such hard infiltrations are, as already shown, associated with benign neoplasms, and from this fact it follows that they have a direct bearing on cancer formation as shown by Hartmann. As in other cancers of passages in the body, they cause infiltration, fixation, obstruction, hemorrhage, destruction and lymphatic involvement. These factors complete the picture but suggestive outline or sketch of the disease is furnished by bleeding without urination or erection.

The urethroscopic picture is supplied strictly by only three reports in which the diagnosis was reached by the urethroscope. These are the cases of Gruenfeld,<sup>1</sup> Oberlaender,<sup>2</sup> and Beck.<sup>3</sup>

These cases may be summarized in the following terms as showing variations in the findings:

*Case of Gruenfeld.*—The lesion was carcinoma. Insertion of a straight tube for 12 cm. discovered a yellowish-white, pedunculated, polypoid outgrowth. A second flattened tumor was situated 4 cm. cephalad. This, too, was yellow-white. In the deep urethra the entire mucosa was peculiar. Near the colliculus was a congested band curving toward the right and the other elements of the picture were a mass placed across the canal, partly red and partly pale, with a surface uneven, furrowed, excavated in spots and vascular. A delicate septum appeared during withdrawal of the urethroscope, showing a hemorrhagic livid zone above and an ulcerated zone below. Changes in position and rotation of the mass disclosed ulcers and in the lower aspect two spots of facets.

*Case of Oberlaender.*—The growth was a squamous-celled cancer. On passing a 27 F. urethroscope to the bulb a crescentic whitish sclerosis and a grayish dry annexum of mucous membrane was encountered and others much similar were scattered along the canal as far as the fossa navicularis with many folds and follicular and glandular involvement. This growth had cephalad to it a red and raw, irregular and friable, lobulated and raspberry-like mass which came into the field clearly on making traction on the penis.

*Case of Beck.*—The neoplasm was a squamous-celled carcinoma. The mass was near a stricture, hemorrhagic, papillary and placed on the dorsal and right walls of the canal.

Berkeley Hill, in consultation, urethroscoped the patient. The previous report lacks definite proof of stricture, as perhaps intended. The man was sixty-one years old, and at eighteen years had a brief gonorrhea. Stream always progressively reduced, until six months

<sup>1</sup> Grünfeld: Die Endoscopie der Harnröhre und Blase, Deutsche Chirurgie, Lief. 50, 193.

<sup>2</sup> Internat. Centralbl. f. d. Physiol. u. Pathol. d. Harn. and Sexualorgane, 1893, iv, 244.  
<sup>3</sup> Internat. Clinics, 1892, 2, S. ii, 256.



before consultation only No. 1 catheter could pass. At the same time there was a swelling in the perineum and dysuria. Later No. 6 catheter could be passed. Catheter life at home soon produced hematuria. Admitted to hospital with hard perineal swelling, 3 x 12 inches. No pain. No cachexia. Prostate and membranous urethra healthy. No enlarged lymph nodes. No false passage. Stricture four inches back from meatus. Perineal section. Palliative procedure. Death. No autopsy. Squamous-celled cancer judged from biopsy.

The diagnosis will be furnished early with the aid of the urethroscope, which offers a far more opportune moment for operation and thus avoids relapses and recurrence. In many of the records the disease was known only by perforation of the urethra or by obstruction, extravasation and sinus formation. Hall collected 21 cases with absolutely pathologic diagnosis, in which the report of Oberlaender was the only one in which the tumor did not return in less than a year after intervention. Urethroscopy and diagnosis are required in the face of bleeding independent of urination or erection, altered stream or function and a hemorrhagic, warty growth during the carcinomatous period of life. The growth may be snared or clipped for a specimen, which will make the diagnosis final. These growths have no termination other than that of enlargement, extension, ulceration and metastases, which are delayed but apparently never avoided even by operation.

*Sarcoma.*—The forms are primary and secondary, as noted for carcinoma and the benign neoplasms. The occurrence is intrinsically rare, compared with other new growths and with various other urethral lesions. Women are much more commonly the victims, but several well-established cases are reported in the male. In European medical literature the first accepted notes are those of Hoening,<sup>1</sup> on fibrosarcoma. Similar reports occur every few years up to the present time, including those of Rizzoli<sup>2</sup> and Tillaux.<sup>3</sup>

Beutner,<sup>4</sup> Lejars<sup>5</sup> and Albarran<sup>6</sup> say much of vesical tumors, but mention no urethral tumors and have no individual case reports.

In American medical literature Hall and Frick<sup>7</sup> have described a melanosis which on autopsy gave good evidence of urethral source. Later, Mark<sup>8</sup> details a primary urethral sarcoma. The urethroscopic picture is sufficiently suggestive to stand as probably typical. A 24 F. air-dilating urethroscope was arrested near the corona. Dilatation revealed irregular pale polypoid masses scattered along the whole wall of the urethra. Penetration of the tube to the scrotal urethra scraped off several of the masses, whose hemorrhage delayed further observation for a few days. These specimens were lost. A second examination secured other specimens from the deeper anterior

<sup>1</sup> Berl. klin. Wehnschr., 1869, p. 55.

<sup>2</sup> Boll. di sci. med. di Bologna, 1873, xvi, 145.

<sup>3</sup> Ann. de gyn., 1889.

<sup>4</sup> Leçons de Chirurgie, 1895, p. 598.

<sup>5</sup> Jour. Am. Med. Assn., 1906, xvi, 1911.

<sup>6</sup> Tr. Am. Urol. Assn., 1908, ii, 13; 1911, v, 59; Ann. Surg., March, 1912.

<sup>7</sup> Centralbl. f. Gynäk., 1894, xxviii, 136.

<sup>8</sup> Médecine opératoire, 1909.

thra up to the membranous canal. A cystoscopy revealed marked stricture, severe cystitis but no new growth within the bladder. The lesion was a sarcoma.

For the diagnosis there is nothing absolute except the microscope, but a sessile, hard, scarlike growth of relatively slow advance and great infiltration suggests a sarcoma. If the prostate is in a similar condition the lesion probably is secondary and contiguous.

Carcinoma and sarcoma are the growths included and the urethroscope is an instrument of diagnosis and never of treatment. The urologist is at once compelled to adopt radical ablation, including a large part of the surrounding tissues. In modern view the immediate application of intensive x-ray treatment to the open wound is one of the most potent means of aftertreatment to postpone or prevent relapse. Cure must in these dangerous growths mean relief from relapse. The two or three years relied on in general surgery as a cure.

**Urethral Calculi.**—The forms are primary, which develop within the urethra itself, or secondary, which arise in the upper urinary organs and lodge within the urethra in their transit. The primary calculi are the direct product of obstruction, stagnation, decomposition, precipitation and formation of the stones. The urine is delayed by the obstruction and its solid elements mix with mucus and precipitate and then form the concretion. They are therefore found in stricture, fistula, diverticulum and valves. Like other calculi they have a kernel or nucleus usually consisting of hardened pus, fibrin and epithelia or even a sympexion from the prostate or seminal vesicle as reported by Mark<sup>1</sup> in a man, forty-four years old, who had been voiding gelatinous ovoid masses from time to time much like the urethral excretion of Robin. An elastic stricture contracted and pocketed a stone proximal to it. This was discovered and removed through the urethroscope and found to be a shell of phosphates containing a dried kernel which was undoubtedly one of Robin's bodies.

The bladder during lithiasis may become encrusted through the precipitation of salts upon its roughened surface. Chute<sup>2</sup> has described analogous crusts in the urethra, formed during a tuberculous process. Foreign bodies have been retained in the urethra long enough to become covered with precipitated salts, but this process is not strictly a lithiasis.

The secondary stones originate in the kidneys, ureters, bladder or prostate and in their passage into the outer world are held up in the normal or pathologic urethra. In site they may be partly within the bladder and urethra, forming the vesicourethral deposits, or partly within the prostate and the urethra comprising the prostatourethral concretions or wholly within the urethra making the truly urethral concretions. The author has never seen any but the last type in his own practice. Casper<sup>3</sup> reports a case of stone lying within the prostate and the canal, and there are other similar case records by noted authors.

Loc. cit., p. 219.

<sup>2</sup> Boston Med. Jour., 1903, cxlix, 361.

<sup>3</sup> Text-book of Genito-urinary Diseases, translated by Bonney, 1909, ii, 386.

The author<sup>1</sup> reported a case of urethral lithiasis in a Chinaman whose specimen is shown in Fig. 179, and a case of multiple prostatic lithiasis in an aged sailor who passed them during urination. The specimens are shown in Fig. 361.

**Treatment.**—Stones in the bladder should be removed at once, as prevention of their washing into the urethra and lodging at some normal or pathological narrowing of this canal. Stones which are located both within the urethra and the bladder or the urethra and the prostate will require cystotomy or prostatotomy for their removal. Stones which have lodged or formed within the urethra may be taken away only by external urethrotomy, as was the procedure followed by the author in the urethral stones shown in Fig. 179. The immediate aftertreatment of all these operations is given under each and the remote aftercare is sufficiently discussed under lithiasis in Chapters XIV, XV and XVI, so far as habit, diet and medication are concerned. Attention to obstructions of the urethra is noted under Stricture in Chapter VII.



FIG. 179.—Urethral calculus, impacted cephalad to an anterior urethral stricture; removed by external urethrotomy. (Author's case.)

### URETHROSCOPY IN THE FEMALE.

**Significance.**—In woman, as in man, urethroscopy is most important for diagnosis, treatment and prophylaxis in both the personal and social senses. Similar lesions such as hypersensitiveness, narrow meatus and stricture, as in the male, may prevent ready examination and hence the foretreatment should be sufficient to accustom the patient to such manipulations. The distribution of lesions begins in the bladder and ends at the vestibule, hence a proper urethroscopy should begin with the trigonum of the bladder and end at the meatus exactly as in the male.

**Instruments.**—Naturally the same five classes are available as stated in the historical recapitulation of the science in the male, but in modern practice the same choice is made and in the author's opinion should embrace at least one intrinsic illumination, water dilatation, magnifying, lateral fenestrum, operation cystourethroscope and one intrinsic illumination air-dilatation, magnifying, terminal fenestrum, operation urethroscope. The same accessories in instruments and medicaments are available as in the opposite sex and naturally the procedure does not

<sup>1</sup> New York Med. Jour., 1913, xcvi, 482.

ry between the sexes in the remote and immediate preparation of the om, patient and attendants.

**Technic.**—The process of passing the urethroscope in woman has ur steps: insertion, advancement, depression and penetration.

By insertion the instrument is engaged in the mēatus while the labia e held apart and this is followed by advancement which carries the p to the neck of the bladder, which is usually at an angle with the axis the urethra. Depression of the eyepiece brings the obturator into e line of the neck and then gentle penetration carries it through the t-off muscle into the bladder, where its presence is shown by flux urine when the pilot is withdrawn.

The identical rules of gentleness, patience and deliberation must be llowed in the female, as in the male, and these cannot be too much phasized in practice.

**Anatomy of the Urethra.**—The details of the gross and minute struc- re of the female urethra have been mentioned in the Chapter on onococcal Urethritis. The chief elements are the folds of the muscle the neck of the bladder, the mucous crypts, Skene's glands and the t that the mucosa is continuous from the vestibule to the bladder.

### Normal Clinical Features.

Naturally the general aspects and arrangement are not unlike the aracteristics of the deep urethra in the male, of which it is the homo- gue. We find therefore that delicacy is shown by the thickness, edom by the attachment, positive redness by the color, definite orillation by the vessels and elasticity by the structure as a whole. he crypts and glands are both moderately abundant and the laxity ad folds are more numerous than in the male, where the prostate seems o prevent them. Skene's glands are homologous with Cowper's lands in man and are equally important.

### SPECIAL NORMAL FEATURES OF THE URETHRAL SEGMENTS.

The female canal is not divisible into the anatomical portions, as the ale, but in clinical urethroscopy the neck of the bladder, urethra and eatus. The vesical neck is usually characterized by a rounded trans- rse eminence which forms a complete collar made up of the circular uscle fibers and is striated by numerous axial furrows marking the ngitudinal muscular bundles. The appearance is typical of the rse-string arrangement of the sphincter muscle. The urethra has ft, lax, mucous membrane containing numerous follicles and glands. he meatus is a dimple and contains at or within its margin the two cts of Skene's glands, one on each side.

### Pathological Clinical Features of Urethroscopy.

As in men, so in women, one must distinguish the gonococcal from the gonococcal manifestations.

### A. Gonococcal Lesions.

In the process and results of gonococcal inflammation much the same changes develop in both the female and the male urethra. The delicacy of the mucosa is altered or lost by thickening and the attachment becomes more dense. Color and vascularity are greatly heightened to a livid red in active spots or decreased to a paler hue where infiltration has reduced the blood supply. Altered elasticity is manifested along with the foregoing processes. The crypts, glands and lacunæ are similarly affected so that one sees glands in which an active process produces increased secretion and those in which atrophy induces dryness and loss of the normal mucus. The laxity and folds of the mucosa may be increased or decreased and its gloss abolished by loss of surface epithelia or cellular substitution. It must be remembered that all these general lesions are variously related to each other and scattered along the canal. In woman the urethra is so short that the variations and groupings are less manifest than in the male.

### Pathological Special Features of Urethroscopy.

The list is identical with the one given for the male in the nature of the identity of the soil and of the infecting organism. There are therefore seen soft infiltrations and bullous edema. Infected glands with gaping ducts and thick discharge or no discharge occur with the moist or dry form of glandular compromise. Cellular change is represented by granulation tissue, polypoid masses, exfoliation and ulcers. Stricture formation is the transition from soft infiltration likewise through cellular modification and often results in deformity, although tight stricture as such is very rare in woman. More minute details of all these lesions are given under the subject of Chronic Gonococcal Urethritis on page 264 or under Urethroscopy in the Male on page 616.

### B. Nongonococcal Lesions.

There is no difference in the varieties and significance of these conditions between the two sexes, but several of them are either less or more common in women than in men.

**Anatomical Abnormalities** in the form of valves and diverticula are much less frequently encountered in women.

**Special Inflammations and Infections** have about the same occurrence and importance and catalogue the same lesions, notably urethritis of catarrhal, suppurative, herpetic, tuberculous, chancroidal and syphilitic origin. They do not differ in any essential clinical detail from the descriptions already stated for them in the male, with due allowance for anatomical arrangement.

Neoplastic urethritis is the first to show differences although the essential subdivisions into primary and secondary, benign and malignant growths must be followed. The frequency is greater in women

men in accordance with the law of all neoplasms. Secondary are most common of all through contiguity of organs commonly 1—uterus, vagina and bladder.

**Benign Neoplasms.**—Under this heading are comprised the same as just noted in the male.

**Papilloma.**—Papilloma has the same clinical aspect as in man and about the folds of the vulva and the surface of the vestibule. Urethral specimens are often associated and are easily recognized with the urethroscope.

**Polypus.**—Counting the vascular polypi as the chief form, polypus is more common in woman than in man, but on the other hand, polypi are by no means uncommon and may enlarge, elongate pedicles and by muscular action present at the meatus exactly as polypi appear at the os externum. Their clinical characteristics are the same as those seen in the male and likewise their urethroscopic

**Vascular Polypus.**—The vascular polypus is also called caruncle, caruncle and angioma. It is the most common of all polypoid growths, including both sexes, and the last term typifies its nature. As already stated, it is rare and almost inexplicable in the male. Its basis is assumed to be misplaced erectile tissue in woman, but not characteristic of the female. The site is at the meatus or near the meatus, and like polypus is often crowded outward. Its structure is a connective tissue stroma filled with tufts of capillaries, richly innervated and covered with stratified epithelium. They are single, but may be multiple. The urethroscopic picture is peculiar but the use of the instrument is not necessary because the finger will make the diagnosis on everting the meatus. They are soft, red, tender and soft tufts of mucous membrane, bleed easily and are either sessile or pedunculated in their attachment. Their removal rests on operative removal as the aggravation of urination and recurrence increases their size and symptoms.

**Varices.**—On account of the erectile sinuses in the vulva which themselves become varicose enlarged venules in the urethra, especially around the meatus, are much more common in woman than in man.

The influence of pregnancy in causing extensive distention and dilatation of the veins is another factor in this greater frequency. The diagnosis is usually so obvious that a urethroscopy is unnecessary. If needed, the instrument may cause bleeding of obstinate type from the varices.

**Malignant Neoplasms.**—Carcinoma and sarcoma, primary and secondary are the forms recognized.

**Carcinoma.**—The frequency of cancer in and about the uterus, vagina and bladder makes secondary lesions much the more common. If the diagnosis is already established from the initial focus so that urethroscopy is unnecessary, with the sole exception of some vesical cancer originating in the neck of the bladder and extending into the urethra. The primary growths may arise at any



point of the mucosa as site and show the urethroscopic pictures described for the male. Naturally their clinical course is the same.

**Sarcoma.**—The forms are the same as those enumerated for the male and the lesion is much more common in woman, according to Marks, in the work already cited. Legueu,<sup>1</sup> however, states as the result of investigation that sarcoma is found chiefly in women during adult life: of 10 recorded cases only 2 appeared in women seventeen and twenty-two years old. Legueu contributed no personal material. Ehrendorfer<sup>2</sup> has noted a well-founded case. The diagnosis is usually established by ordinary physical examination as a large, hard mass but there is nothing pathognomonic of the lesion. Urethroscopy may furnish additional evidence.

**Calculi.**—Lithiasis of the urinary tract is decidedly common in women, although not so common as in men. Primary stones of the female urethra are practically unknown on account of the shortness, dilatability and muscularity of the canal. Secondary concretion is likewise very rare. Finsterer<sup>3</sup> has produced the best study of this subject with the result of discovering only 14 recorded cases in literature. Their symptoms, course and diagnosis would be much the same as in the male with allowance for anatomical distinctions. The recognition of the stones may be made with a probe as well as with the urethroscope.

### THERAPEUTIC URETHROSCOPY.

**Varieties.**—The influence of the sexes is not a great one because many of the essential chronic lesions occur in the mucosa of men and women alike. For this reason both the male and the female are implied in the foregoing descriptions. Of greater importance are the differences between the gonococcal and the nongonococcal lesions. The former are the most manifest and are therefore given first place in the following paragraphs as the typical foci.

**Gonococcal Lesions.—General Principles.**—It should always be remembered that urethroscopy is only associated with the other methods of treatment and that it is used in alternation and in sequence with such other methods. This viewpoint is always implied in the following paragraphs.

**Management.**—Urinary antiseptics are advisedly given as preliminary precautions, and if the work is at all severe, rest in bed overnight is a wise protection against hemorrhage and other results. Irrigation of the urethra with styptics and antiseptics after the instrument is withdrawn will often keep down immediate distress on the part of the patient. The best is nitrate of silver in strengths of 1 in 2000 to 1 in 500, with preference for the weaker solutions, relatively larger quantities and heat to toleration. As in treatment of gonococcal urethritis by other means, nonstimulating diet and the drinking of much water

<sup>1</sup> *Traité Chirurgical d'Urologie*, Paris, 1910, p. 975.

<sup>2</sup> *Centr. f. Gynäkol.*, 1892, xvi, 321.

<sup>3</sup> *Deutsch. Zeitschr. f. Chir.*, 1906, lxxxi, 140.

advisable. Medicinal measures are represented by continuation need may require of the drugs employed during other forms of treatment.

**Methods.**—As in the treatment of urethral lesions in general, so in urethroscopy the details are nonoperative and operative. This distinction means that through the urethroscope applications of medicaments may be made as well as operations done, but, on the other hand, urethroscopy is itself operative and should be so considered in all respects from preparation to aftercare.

No matter whether drugs are applied or instruments used through the urethroscope the lesions are the same in both anterior and posterior portions of the canal and conservative gentle measures used several times are much more safe and efficient than severe treatment used once. The vulnerability of the mucosa to disease and to medicinal or operative treatment is the same, which means that anything which damages the membrane severely may damage it beyond recovery and in that case destruction of the mucosa should be very cautiously undertaken. In the use of the d'Arsonval high-frequency current and the Oudin high-frequency current a special cable and electrode are advisable, though an ordinarily well-insulated wire will often serve the purpose. Among the special electrodes none is better than that of Bugbee.

**Nongonococcal Lesions.—Principles and Management.**—Nongonococcal conditions have much the same basis and indications as the gonococcal with due respect for the difference in the underlying infections and lesions. The frequency of catarrhal reaction associated with these nongonococcal diseases is one of their most important peculiarities. In each of the foregoing descriptions the various important features are already noted.

**Methods.**—The medicinal means must be adapted to the special form of infection. The urethroscopic group of cases are necessarily chronic in their manifestations and require appropriate attention. Notably catarrhal, suppurative and syphilitic invasions have their particular and familiar requirements by systemic administration. Chancroid requires its own local measures. Each such method of treatment has been discussed under its own disease. Surgery is applied to the vast majority of these cases already shown in each pathological sample.

## CHAPTER XIII.

### CYSTOSCOPY.

#### GENERAL CONSIDERATIONS.

**Introduction.—Basic Principles.**—A surgical procedure such as cystoscopy rests on certain bases which should be firmly founded in the mind of the student and beginner before he may expect to make any material progress or reach true success. These basic principles will first engage attention, and include in particular the general indications of cystoscopy, the confirmations of cystoscopy, the special indications of cystoscopy, the laboratory indications of cystoscopy, the miscellaneous important indications of cystoscopy, the contra-indications of cystoscopy and other urological instrumentation and the case records in urology.

The description of the various types of cystoscopy and the discussion of the application of cystoscopy to the different pathological processes of the urogenital tract will comprise the subject-matter of Chapters XIV, XV, XVI and XVII.

**General Indications.**—Advances in electricity resulting in the production of exploring instruments in many of the arts and sciences have given medicine the urethroscope and cystoscope and many other instruments of the diagnostic and therapeutic type, such as the rhinoscope, laryngoscope, auroscope, proctoscope and the like.

Advances in objective diagnosis in all branches of medical science have reached no greater progress than in urology through urethroscopy and cystoscopy and their adjuvants—the various renal tests and radiography.

The urethroscope is the instrument of objective diagnosis of all the organs of the lower urogenital tract: in the male, the urethra and the glands and ducts adjoined to and emptying into it, namely—the prostate, testicles, seminal vesicles through their ejaculatory ducts, Cowper's glands through their outlets and the simple and complicated mucous follicles; and in the female the urethroscope is of value in exploring the urethra, which in woman represents as much of the urethra in man as lies above the outlets of the sexual glands referred to. In children, urethroscopy is practically impossible.

The cystoscope is the means of localization of lesions of the intrinsic organs of the urinary group which include the bladder, the ureters and the kidneys in the male and female, in both the adult and, with certain restrictions, the child.

The various organs of the sexual and urinary systems are not only complex and refined but their nervous control, centripetal and centri-

al, is located in about the same segment of the spinal cord, which accounts for the close relation of physiological and pathological manifestations. The many tissues of these organs are so delicate and their structures so analogous that they are all subject to much the same types and degrees of disease. The physiologic continuity of the urinary apparatus from the kidneys to the urinary meatus in both sexes renders possible direct transmission of many diseases from a single focus, distally and proximally, until the whole system becomes more or less involved. Exactly the same state of affairs applies in the sexual organs, owing to continuity between the urethra of the male and the prostate, seminal vesicles, vasa deferentia and testicles, and, in the female, between the ovaries and the vulva through the tubes, uterus and vagina.

The readiness with which a single focus at any point of these systems, especially perhaps the urinary system, becomes a generalized disease, renders the earliest possible diagnosis of its nature of the greatest importance for scientific treatment. For example, such a focus of tuberculosis in one kidney may be transferred through the urine to the ureter and bladder, distally and then proximally through the other ureter to the opposite kidney, then again by way of the urine it may locate in the prostate or testicles. That these infections may, of course, also travel by way of the blood and lymphatic currents, must also be remembered.

Syndromes or symptom-groups without urethrocystoscopy for careful distinction and analysis may give a definite diagnosis, especially in medical disease of the urogenital tract. Much less commonly are they of avail in the surgical affections. Exactly the same comment is true concerning syndromes combined only with urinalysis. Urinalysis may fail because its physical, chemical and bacterial elements rarely give definite bearing on their sources and seats in very exact degree.

**General Confirmations.**—Although diagnosis in urology may be established by urethroscopy and cystoscopy combined with such appropriate procedures as urethral catheterization and urinary separation, it is advisable always to employ such confirming elements as the subjective and objective symptoms and signs, urinalysis, photography and radiography.

All diagnosis comprises four parts, as does a picture-frame. One part is a detailed subjective history, another a careful physical examination, the third a complete laboratory investigation and the fourth the results of treatment. In urology these parts are of great importance, inasmuch as a focal diagnosis rests largely upon the thoroughness with which each of these elements in the case is investigated.

The careful subjective history must have respect for the past of the patient; that is, family history, former general history, former venereal history and former urological history.

The family history includes the age and health if living and age and cause, if deceased, of father, mother, brothers and sisters and of children.

The former personal history notes previous illnesses, constitutional and infectious, especially of heart, lungs, liver and nervous system; condition and course of health; digestion, as to appetite and bowels; nervous system respecting sleep and capacity for work; habits in alcohol, tobacco and food; effects of accidents and operations.

The former sexual history respects masturbation in onset, severity and duration; first intercourse; subsequent intercourses in regularity, frequency, desire and pleasure.

The former venereal history should record urethritis, as to dates, duration, complications and treatment of each attack; syphilis concerning date and seat of chancre, incubation, severity and course of symptoms, kinds and length of treatment and results to date; chancre, warts, herpes, psoriasis and eczema are all of less importance.

In the former urological history, in kidney cases, thorough inquiry must be made as to the causes<sup>1</sup> of nephritis, among the more common of which are: infection (measles, scarlatina, typhoid fever, diphtheria, smallpox, chickenpox, malaria, pertussis, mumps, tonsillitis, rheumatism, cholera, pneumonia, pleurisy, erysipelas); exposure to cold; toxic agents (turpentine, cantharides, potassium chlorate, phenol); extensive injury or disease of the skin; chronic suppurative disease (tuberculosis); heredity; alcoholic habit; overeating; vocations (chronic lead and phosphorus poisoning); gout and injuries to the kidney.

The foregoing catalogue of renal cases may be subdivided into those involving toxins, congestions and heredity.

1. The toxins are the infection, poison, suppuration, alcoholism, overeating, vocation and gout cases.

2. The congestions are the exposure, cutaneous injury and renal trauma examples, while

3. Heredity is the third group singular and peculiar to itself.

Where albuminuria is present its causes other than those of nephritis must be investigated. The more usual of these are comprised in the following classes as given by Butler:<sup>2</sup> hemic (scurvy, leukemia, purpura, anemia, jaundice, diabetes), circulatory disturbances (chronic cardiac or pulmonary disease, pressure upon renal vein), neurotic (apoplexy, tetanus, migraine, delirium tremens, Graves's disease, cephalic injuries), functional (cyclic—following a hearty proteid intake, following cold bath or severe exercise, constipation), renal disease (amyloid and fatty degeneration, neoplasms, suppurative nephritis), extrarenal disease (pyelitis, ureteritis, cystitis, urethritis, prostatic disease, presence of semen in urethra).

The foregoing list may be classified again into two groups:

1. Intrinsic, proceeding from the kidney itself; including organic and functional renal disease as stated, and

2. Extrinsic, arising outside the kidney itself, embracing the hemic, circulatory, neurotic and extrarenal lesions, as enumerated by Butler.

<sup>1</sup> Osler: *The Principles and Practice of Medicine*, 1916, viii (adapted).

<sup>2</sup> *The Diagnostics of Internal Medicine*, 1909, iii.

The record of former attacks of disease of the bladder will complete part of the history.

After the elements in the past history have been covered as thoroughly as the general aspect of the case warrants, the present condition the patient demands attention.

Present general, venereal and urological histories must therefore be recorded and recorded.

As a rule many cases for urethroscopy and cystoscopy present a present general history which contains little of interest excepting chiefly tuberculosis, neoplasms and calculus.

The present general history must inquire into concomitant conditions, chiefly tuberculosis, neoplasms and calculus formation, and monary, cardiac, vascular and hepatic lesions which are so usually associated with urological conditions.

The present venereal and urological histories usually merge more or

less. We are interested in the subjective story concerning the duration of the symptoms and their main facts. The "chief complaint" is the most possible "lead" and must be particularly inquired into. Then comes the function of urination, its hourly increase or decrease, by day or night, changes in the form, size and force of the stream, increase or decrease of quantity, changes in the nature of the act, urgency, control, interruption, obstruction, suppression; pains in the kidney, ureter and bladder zones; pains in the sexual organs, their relation to urination, defecation and copulation, rest and activity, their cause, urgency, cause of increase or decrease, constancy, remission, intermission, duration, character; directions of travel and points of reference.

Data in both sexes similar to those concerning pain should be elicited for urethral discharges and for blood and pus before, during and after urination and coitus, and in women for vaginal conditions also. Gravel deposit in the urine is very important.

Disturbances of the sexual organs; variations in desire, ejaculations, orgasm and sensation; in women, dyspareunia; functional disturbances, especially of the nervous system and of the gastrointestinal tract all have their bearing.

Functional disturbances must not be overlooked. Those of the nervous system embrace neuroses, depression, melancholia, exaltation, hypochondria, indifference, irritability and sleep. Functional disorder of the digestive system should refer to the stomach, liver and intestines. Constipation is usually very important.

Complete physical examination should follow "leads" from the history at large and from the urological system in particular. It therefore must be both general and urological. The latter should include instrumental and instrumental investigation.

Physical examination should always employ inspection, palpation, auscultation, percussion and auscultation in detail and must include circulation, heart, arteries and veins, the lungs, liver, with the function of the digestive system and the cerebrospinal axis: all in



essential corroboration of urological findings. Blood pressure and anemia are specially important.

The positions in physical examination are the standard: erect, supine, prone, right and left lateral, stooping, genufacial, lithotomy both normal and exaggerated, and Trendelenburg's. The stooping posture is either over the edge of a table, as for rectal examination, or supported on the surgeon's shoulders, as for kidney investigation. Percussion may be with the fingers for ordinary work or with the fist and hand for the kidneys.

Complete urological examination embraces sexual, urethral and vesical details, ascertainable by means other than urethroscopy and cystoscopy.

A *sexual investigation* in children and adults varies with the sex. In male subjects the penis, scrotum, testicles, cords, seminal vesicles and prostate, especially for any changes in size, form and consistency, with their bearing on the bladder floor, are included. In female individuals one explores the vagina for tears, particularly of the anterior wall, the uterus for enlargement, version, displacement and descent, mobility and fixity, and its annexa for enlargement, inflammation and adhesions; because any or all these features influence vesical conditions. Changes in the vagina appear chiefly on the floor; alterations in the uterus affect the fundus excepting in descent; while affections of the annexa show themselves usually at the sides of the bladder. In virgins anesthesia is required for vaginal examinations, to which rectal exploration is to be preferred when possible.

A *urethral investigation* implies palpation and instrumentation, with various forms of catheter, sound and ordinary external inspection and internal inspection with the urethroscope and cystoscope.

Small soft-rubber catheters are used for irrigation of the urethra, for isolating specimen discharges from the anterior and posterior urethra, for distinguishing pus in the urine of urethral from pus of vesicle origin as in the author's<sup>1</sup> seven-glass test or Wolbarst five-glass test or other multiple glass tests. Bougies-à-boule or ball-sounds fix the number, location and diameter of strictures of both endo-urethral and extraurethral origin. The flexible is preferable to the metal type of ball-sound. Urethral sounds with straight shafts and shafts having standard or Béniqué curves, supplement the findings with the bougies-à-boule. Sounds having round tips are to be chosen rather than those having conical points for locating strictures, while the reverse is the choice for dilating them.

The urethroscope is of value for the end-to-end study of the mucosa for sources of blood, mucus, pus and epithelia in the urine, not of vesicle origin. The straight Buerger cystourethroscope permits such examination at one sitting.

The cystoscope and the cystourethroscope are of importance in examining the sphincter muscle immediately within and without the bladder as a possible source of urgency, tenesmus or blood.

<sup>1</sup> Pedersen, V. C.: Tr. Am. Urol. Assn., 1916, x, 61,

The physical examination of the bladder is an adjuvant of cystoscopy. Its means are the catheter, stone searcher, sound, x-ray and cystoscope.

Silver, soft-rubber and a large variety of soft, woven, varnished catheters are available for the purpose. The important special forms are the single elbow, double elbow, olive point with straight, curved, single elbow and double elbow shafts, and round point with straight or curved shafts. Any of these types may be cylindrical or flattened in cross-section, especially the elbow catheters, because they are employed in prostatic conditions. Silver catheters are tunnelled and grooved at the tip, round pointed, with standard and Béniqué curves but have largely been supplanted by the foregoing flexible types and by the irrigating sounds devised by the writer which have a silver catheter passing through the shaft to the base of the groove in all types and sizes.

The stone-searchers are detailed in lithiasis of the bladder. The best models are Thompson's nonirrigating type and the author's<sup>1</sup> irrigating model. The sounds are of the flexible and steel forms which are fully discussed in the Chapter on Stricture of the Urethra on page 375. In this same subject likewise are given the full details of their application in diagnosis and treatment. The steel sounds are of the standard Béniqué type, with or without irrigation. The author's<sup>2</sup> irrigating sounds are the best for general service.

Radiography is of manifest value and its application will be considered when various conditions are discussed hereinafter.

The physical conditions of the bladder, which are examined by the beforementioned methods, are as follows:

The catheter shows the condition of the vesical urine, independent of the urethral urine, the capacity and irritability and the amount of residual urine of the bladder as in enlarged prostate.

The stone searcher is an aid in finding vesical calculi when the cystoscope cannot be introduced and the x-ray is not available. The author's irrigating type of stone searcher is to be preferred. Its beak hooked downward over an enlarged prostate, or slowly passed over and along it, outlines prostatic enlargement, and in some cases the location and size of tumor.

The sounds are available, but less advisedly so, than the catheters for indicating bladder capacity.

The author's irrigating sound is an exception to this dictum and likewise his device<sup>3</sup> for using gum-elastic catheters as sheaths upon lead-core dilators as obturators, for exploring the urethra and bladder.

The ureteral and renal examination is performed by inspection, palpation, percussion, mensuration, photography, urinary separators, the cystoscope with the ureteral catheters, the functional test and the

<sup>1</sup> Pedersen, V. C.: Med. Rec., February 19, 1910.

<sup>2</sup> Pedersen, V. C.: Ann. Surg., October, 1909.

<sup>3</sup> Am. Jour. Urol., March, 1910, also Tr. Am. Urol. Assn., 1910, iv, 92.

polyuria tests of the kidneys. Inspection, palpation, percussion, mensuration and photography are not always available, as many kidney cases do not give objective indications under them. Advanced cases of tumor and hydronephrosis do. Radiography is, on the other hand, indispensable because many ureterorenal conditions cannot be diagnosticated without it.

The Luys separator is of doubtful value when directly compared to cystoscopy with ureteral catheterization. It may be used as a corroborator of the latter in any case or as a substitute when catheterization is impossible. It should be included in the office equipment of every urologist.

**General Indications.**—The cystoscope and ureteral catheterization, by means of which the numerous surgical and medical conditions of the ureters and kidneys are explored, directly as an instrumental investigation and indirectly through the functional and polyuria tests, is without equivocation the instrument of choice. The details of its construction and medical application will be hereinafter fully discussed, along with the features of the tests alluded to.

The various ureteral and renal conditions for investigation comprise inflammation, foreign bodies and neoplasms. The inflammation may be bacterial, as pyogenic and tuberculous, or nonbacterial, as chronic interstitial. The foreign bodies embrace precipitates as gravel and calculus, single or multiple, small or large. Neoplasms embody less commonly nonmalignant and more commonly malignant, forms, the recognition of whose earliest possible stage is of supreme moment.

**Special Indications.**—These are derived from disordered urination, physical, chemical and microscopic urinalysis, miscellaneous symptoms and correlation with surgical work.

The disorders of urination are chiefly mechanical and include increased frequency, ischuria, dysuria, spasmodic obstruction or interruption and enuresis.

Increased frequency of micturition is the most common and prominent cause of the disordered function, and originates from the urethra, bladder, kidney and ureter, cerebrospinal axis and systemic diseases.

The urethral causes of frequency are located chiefly in the posterior urethra and proceed from acute and chronic inflammations, particularly of gonococcal origin. The inflammation induces in the mucosa of the urethra all those changes which it does in every other mucosa and which lead to irritation and consequent frequency. These changes are commonly localized or more or less generalized thickening of the mucosa as a whole, cicatrix with secondary stricture, cysts, papillomata, folliculitis of the urethral and prostatic glands, affections of the colliculus and ulceration.

Frequency of micturition is due to vesical conditions, such as disease of the bladder in general, hyperacidity and hyperalkalinity of the urine with their precipitates, edema and swelling of the trigone and outlet inflammation of the bladder itself, foreign body pathological or interstitial, diverticula and neoplasms, reflex conditions in the bladder

itself excited by renal and ureteric infection and inflammation, foreign body and tumor.

Cystitis and trigonitis may be localized, disseminated, or general as in colon bacilluria, typhoid fever and tuberculosis, provoking frequency by hyperemia and irritative changes in the urine. Foreign bodies in the bladder, such as the crystals of hyperacid and hyperalkaline urine, sand, gravel and stone of decomposing urine, are of pathological origin; while various objects, such as hairpins, fragments of catheters and other surgical instruments, are intentionally or accidentally introduced. All such adventitious matter acts by its physical presence to traumatize and excoriate the mucosa with consequent irritation and frequency of urination. Diverticula of the bladder act as pockets and provoke decomposition and irritation in the same cycle, as just alluded to. Neoplasms of the bladder both benign and malignant cause this symptom by acting as foreign bodies with congestion, inflammation and necrosis. Their deformation of the bladder is also a factor. The prostate provokes frequency of urination by its obstruction, infection, abscess and hypertrophy. Its neoplasm acts through elevation of the bladder floor, and pockets behind it, hyperemia, interference with evacuation and fermentation of urine. The uterus and its annexa act much as does the prostate through displacements, versions, descent, enlargement and fixity. Tears of the perineum and anterior vaginal wall are contributing elements. In this same category should be placed extravescical tumors of bone, muscle or intestine.

Urinary frequency may arise from the upper urinary organs, the kidneys and ureters, through the increased fluid of pyogenic and tuberculous inflammation, and chronic interstitial nephritis. Reflex influences bearing on this symptom arise from foreign bodies, such as sand, gravel and calculi and the early stages of neoplasm in the kidney or ureter or both.

Systemic diseases, such as diabetes mellitus and insipidus, and general conditions, as anemia and neurasthenia, act through disturbed nutrition and increased fluid element in the urine in ways not well understood.

Cerebrospinal origin of frequency may be functional, inducing neurones of the kidney or bladder, or organic in the centers of the lumbosacral region, causing changes in centripetal or centrifugal impulses. Tabes and tumor are the most common.

Retention of urination or ischuria is another important symptom in the function of urination and originates in causes urethral, periurethral, vesical and cerebrospinal in situation.

The urethra may cause it through edema of inflammation and trauma, deformity of stricture, closure by foreign body, pathological, accidental or intentional. Periurethral conditions retain the urine through pressure as in abscess, neoplasm, prostatic enlargement either generalized or focalized at the neck. Vesical causes of ischuria arise in atony of the muscles, the paralysis of overdistention and the mechanical disadvantages of deformity of the bladder floor. Cerebrospinal

factors affect sensation through the centripetal nerves and motion through the centrifugal nerves, either group being partially or totally paralyzed.

Other causes of disorder of the urinary function follow. Dysuria is painful and difficult urination and affects frequency through the fear of the pain and the mechanical factor in the difficulty. Spasmodic interruption and obstruction of urination are seen in the "ball and valve" action of pediculated enlargement of the middle lobe of the prostate and sometimes of foreign bodies. Enuresis in childhood is either diurnal or nocturnal, almost always functional and usually indicates lack of voluntary inhibition. Enuresis in the adult is almost always organic and brings about frequency of urination through deformity and disease of the outlet and wall of the bladder, overdistention from chronic inflammation, muscular atony or hypertrophy and the paralyzes of spinal disease, especially tabes.

Indications in urinalysis may be the earliest and the only reasons for this procedure. Hence all the confirmations of cystoscopy must be carefully applied for a final diagnosis. The physical urinalysis concerns chiefly specific gravity, turbidity and redness. Specific gravity is low in chronic medical inflammations but usually high in surgical conditions of the kidney, owing to the addition of blood and pus. Diabetes mellitus gives advanced but insipidus decreased specific gravity. Turbidity may be due to phosphates which rapidly dissipate upon acidification, or due to carbonates which effervesce in the presence of acid, or due to pus which coagulates by acid and precipitates, leaving a slightly murky supernatant urine. Chyle behaves in much the same manner. Redness denotes blood, varying in intensity from the faintest tinge requiring microscopic confirmation to the color of almost pure blood.

Chemical urinalysis is concerned with albuminuria and its relatives albumosuria, peptonuria, nuclealbuminuria and urea. Pure albumin is apt to be present in the medical conditions of the kidneys and more or less associated with serum albumin and serum globulin, whereas the correlative forms are apt to indicate purulent processes in the body at large or in the urinary tract. Nuclealbumin always means focal urogenital pus. Chemical urinalysis should never neglect urea whose normal amount is 2.6 per cent. by weight, which is open to change temporarily under nitrogenous food and exercise in perfect health from the normal 20 to 35 grammes ( $\frac{2}{3}$  to  $1\frac{1}{4}$  ounces) to a range from the minimum of 10 grammes to the maximum 100 grammes in twenty-four hours. Concentrated urine of febrile conditions usually shows increased urea, while it decreases in kidney disease, unilaterally or bilaterally, temporarily or persistently, progressively or intermittently and periodically or constantly, as the case may be.

Microscopical urinalysis concerns precipitates, pus, blood and casts. Acid urine causes precipitation of uric acid, urates, oxalates, hippuric acid, leucin and tyrosin, cystin and bilirubin. Phosphates may appear in feebly acid and neutral urine. Alkaline urine throws down crystals

triple phosphate, calcium phosphate, basic magnesium phosphate, annular phosphate, ammonium urate and calcium carbonate, rarely in pathological conditions leucin, tyrosin and cystin. Uric acid, urates and phosphates are most important because involved in the formation of calculi.

Pyuria or pus in the urine may be macroscopic or microscopic in quantity, and should in either event be studied with the microscope. It may arise from the genital or the urinary organs. In the former the sources of supply are urethral, prostatic or seminal vesicular. The importance of pus in the urine is fully developed and discussed by a previous contribution of the author.<sup>1</sup> Like all other urinary symptoms it should be traced to its source at once and with the utmost accuracy. The Wolbarst five-glass test is a ready and accurate means of distinction. The writer performs this test in the following manner:

Under strict asepsis and antisepsis of the operator, instruments and patient so far as practicable, a soft-rubber 12 to 16 Fr. catheter is passed to the bulb of the urethra so as to leave free evacuating space around it. The anterior urethra is then irrigated with warm boric acid or normal salt solution under positive but judicious pressure with a 50 c.c. hand syringe. Gentle urethral massage is a good preliminary from the bulb forward. In this manner Glass I is secured, showing the contents of the anterior urethra. Glass II, or the anterior control glass, is prepared by repeating this process and is ordinarily perfectly clear, except perhaps a few shreds clinging and not dislodged before, such as frequently appear in the usual Thompson two-glass test as an unimportant error. Glass III, or the bladder urine, is prepared by passing the soft-rubber catheter into that viscus. If clear urine is drawn we know that the pus does not originate in the urinary organs, namely, the bladder, ureters and kidneys. Glass IV, or the posterior urethral glass, is filled by having the patient evacuate the clear bladder urine, carrying with it the contents of the posterior urethra through the previously cleansed anterior channel. Glass V, or the prostatic massage glass, is obtained by having the patient pass the balance of his urine after thorough massage of the prostate and stripping of the seminal vesicles. Glass V may consist of boric acid or normal salt solution if the quantity of urine is insufficient. It is always wise to complete this test by irrigation of the bladder with the administration of antiseptics, particularly if active infection, like tuberculosis of the prostate, is suspected.

There is preference for the seven-glass test of the author because it has a definite bearing on secretions of the prostate and seminal vesicles in disease. The details of the performance and interpretation of this test are fully discussed under the subjects of Posterior Chronic Urethritis, Prostatitis and Seminal Vesiculitis on pages 313 and 318. They will therefore need no further comment here.

Vesical pyuria may be temporary and declining, or persistent and increasing with intermissions. Its causes in the temporary forms may

<sup>1</sup> New York Med. Jour., December 13, 1913.



be direct infection, in continuity from posterior urethritis, urethrocystitis or abscess of the prostate; or may be by accident through bacteria carried into the bladder on instruments during urethral exploration or treatment, such as catheters, sounds, urethrosopes and cystoscopes; or may be due to inoculation and traumatism during surgical operations on the bladder, vagina and rectum; or may very rarely be excited by the administration of urinary antiseptics. Vesical pyuria in persistent and progressing or intermittent degrees arises from infection incident to calculi, gravel, new growth, specific organisms as in tuberculosis and decomposition of the urine in deformity of the bladder from diverticula and prostatic enlargement. Renal pyuria of temporary and declining degree accompanies acute infectious diseases such as the exanthemata, is commonly of microscopic quantity and usually disappears early or late in the convalescence. Pus in the kidney of severe and persistent degree may be of unilateral or bilateral source from diffuse or focalized infections, single or multiple abscesses, calculi, neoplasm, tuberculosis, pyelitis or pyelonephritis or from deformity with decomposition of the urine as in hydronephrosis. Thus this condition becomes with relation to the ureteric pelvis what the hypertrophied prostate is with relation to the bladder, namely, the cause of urinary obstruction, retention, decomposition and infection.

Hematuria or blood in the urine may also be the earliest and sole symptom of important lesions, therefore the fullest possible corroboration from the system at large should be sought, in addition to regarding it as always an indication for cystoscopy. Hematuria may be incidental, that is, apparently not associated with any other condition or symptom, or it may be distinctly precedent or subsequent to a more or less definite or indefinite syndrome. The quantity of blood may be practically microscopic or macroscopic to the degree of virtual purity, chemically changed or unchanged and may precede, accompany or follow urination. These facts suggest the importance of careful subjective and objective scrutiny of this symptom. Anemia should always be determined and recorded if the bleeding is material in quantity or duration. The sources of the blood are urethral, vesical or renal. The commonest causes of urethral hematuria are traumatism from surgical instruments, implements employed in masturbation and severe, especially gonococcal, infections. Bacteriologic investigation and careful examination will differentiate these conditions. Hematuria of vesical and renal origin is usually explained in much the same way, namely, as proceeding from severe infections as scarlet fever, sepsis and malaria; or from sudden congestion as in extensive destruction of the skin in scalds and burns; or from direct visceral damage through toxins and poisons; and lastly from erosions and ulcers situated anywhere in kidney, bladder, ureter or urethra, inflammatory, neoplastic or traumatic in character and due to tuberculosis, cancer, hypernephroma and calculi. The grave significance of blood in the urine has been carefully discussed by the author.<sup>1</sup> Like pus, blood proceeding from the urinary passages

<sup>1</sup> New York Med. Jour., May 3, 1913.

diagnosed as to its source as quickly and accurately as possible, small lesions amenable to early and radical cure may bleed and then remain quiescent for a long time, while the other lesions of the disease may continue their ravages unknown to the urologist. Tuberculosis and cancer are the best examples of this.

Confirmation of cystoscopy obtained through radiography may never be omitted with either pyuria or hematuria or the lesions which follow, namely, pain, urinary pyrexia, surgical lesions in general and urinary excretion.

**Important Indications.**—Pain in urology is a symptom concerning four factors must always be elicited: "what, why, where and when." Hence we should know the pain in its character, location, maximum intensity, directions and area of reference, cause, recurrence, constancy, remission, intermission, persistence, increase and decrease and accompaniments, especially blood, pus and the like.

Locations of pain in the urogenital tract are in the urethra and generalized in prostatic disease or limited to the glans in vesical disease wherever agitation occurs; or in the bladder by severe infection, calculus and calculus; or in the ureter alone, kidney alone, through the same three conditions. Rectal examination, cystoscopy, cystoscopy, ureteral catheterization and radiography usually settle the diagnosis. Dilatation of the ureteric pelvis cautiously employed in selected cases.

And similar symptoms referred to the right side of the upper abdominal region require consideration of the following sources: peritonitis, kidney pelvis and upper ureter, gall-bladder, pylorus and possibly the head of the pancreas. Cystoscopy, ureteral catheterism and radiography are of vast importance in diagnosis.

Pyrexia or hyperpyrexia (urethral chill, urethral fever) is of septic absorption either from immediate, severe invasion or recrudescence of an old process. It indicates cystoscopy in order to determine its cause. The character of the fever is a sudden 104 degrees Fahrenheit, or over, sustained for few or many hours preceded by one or more very severe chills and followed by prostration and at first by partial or total anuria. It leads usually to exitus in the late stages of nephritis. The absorption is from the urethra and periurethral structures like the prostatic vesicles after manipulation and instrumentation, or from the bladder in cystitis, declining with it, or may be in the ureters and kidneys as in infections and calculi. As a more intense, persistent and serious form is in the upper tract. The effect on the urine is usually anuria or oliguria or commonly polyuria, which may be only apparent through increase in frequency or actual as determined by measure. The presence of blood, pus and gravel is very important.

**Surgical Intervention.**—Surgical intervention is an indication of cystoscopy in discovering anatomical abnormalities such as diverticula of the bladder, absence of the second kidney, presence of horseshoe kidney, and of complete or incomplete double ureter; and in outlining the pathological relations between neoplasms, also inflammatory deposits and the ureters, kidneys and bladder, the position, outlets and courses of fistulae between the seminal vesicles, prostate, vagina, rectum and bladder. In both sexes contraindications to surgical work may in this way be shown or valuable guidance in the steps of the operation furnished. Exploratory cystoscopy has been practically abandoned in favor of cystoscopy with added urethroscopy, procedures which permit nearly examinations of the bladder as a whole, including the neck, and the ureteral outlets which may be investigated much more thoroughly and intimately than with the naked eye through a wound. After cystoscopy the collapsing and folding of the bladder, blood, imperfect illumination, all limit analysis of the case much more than urethrocystoscopy ordinarily does.

**Contraindications.**—Like all other urological instrumentation cystoscopy rests on the dangers of aggravation of symptoms and extension of infection—either into other parts of the urogenital tract or into the system at large. These obstacles may be classified as urethral, vesical, ureteral, renal, prostatic and testicular. Acute inflammatory conditions at any focus of the tract indicate rest and freedom from intervention except in extraordinary circumstances, because infectious elements which might remain at the original point are readily inoculated upon other points not only by the instruments themselves but also by the slight traumatism absolutely unavoidable, which opens the door to extension.

**Cautions.**—Variations in electrical currents require knowledge on the part of the cystoscopist as to the quality and intensity of the circuit in the building where the case is to be explored. The commonest lighting circuit is the 110 volt direct current in large cities, for which the standard urethral instruments and rheostats are adapted. Many hotels and institutes generate their own direct current at 220 volts, which requires a special rheostat of resistance lamps to reduce the tension to 110 volts. Many small towns, for economy, use the alternating current. A special rheostat is necessary to convert it to the direct current, 110 volts, otherwise the patient will be greatly pained, if not alarmed, and the doctor inconvenienced both by restlessness in the patient and by shocks to himself. Fig. 191 illustrates an approved and compact form of such rheostat.

**Case Records.** Accuracy of work and interest in results are obtained by rather uniform methods of recording cases. Lack of space prevents full discussion of this matter but the author's<sup>1</sup> previous contribution contains all details. There are necessary at least forms for the history, urinary cards and analysis reports.

<sup>1</sup> Pedersen, V. C.: Accuracy and Brevity in Office Case Records, *Tr. Am. Urol. Assn.*, 1913, vii, 163.



IV. FORMER UROLOGICAL HISTORY.				Number and details of attacks			
(1) Cystitis				Number and details of attacks			
(2) Nephritis				Number and details of attacks			
(3) Albuminur				Number and details of attacks			
FORMAL VENEREAL HISTORY.							
I. URETHRITIS.				Complicated with Ph. Para. Ad. Bal. Bal P.			
1st Attack				Complicated with Epl. Cy. Pr. Rh. J.			
2d Attack				Complicated with			
3d Attack							
Duration of 1st Attack							
2d Attack							
3d Attack							
Treatment of 1st Attack				Self			
2d Attack				Self			
3d Attack				Self			
Chancroid				Durat			
Warts				Durat			
Herpes				Durat			
Psoriasis				Durat			
Eczema				Durat			
Syphilis				Durat			
Duration				•			
Incubation							
History							
Sore on Glans				Belly			
Shaft				Body			
Junction				Scrotum			
Disp.				Inunction			
Dr.				Self			
Method.				Fumigation			
Ingestion							
Results to date							

## PRESENT ILLNESS

SUBJECT HISTORY:	D	W	M	Y	Ago	Noticed
Duration						
(a) Urination						
Increased daily					Now q	h
Increased nightly					Frequency	Formerly q
Change in Stream					Now q	Formerly q
Change in Quantity					Large	Forked
Change in nature of act.					Large	Dribbling etc.
Urgency					Small	
Control					Small	
Shutting off					Incomplete	Involuntary
Catheterization					Quick	Obstructed
Symptoms (Urinary)					Slow	Interrupted
(a) Subjective					established	Suppression
Pain in:					yes	D
(b) Objective					no	W
Discharges					yes	M
Frequency of Pain					no	Y
Time of Pain					no	Ago
Before						
After						
Degree						
Duration						
Urethral					Thin	Copious
Blood					Mucous	Watery
Gravel					Before	After
Sand					During	Urination
(c) Disturbances of Sexual Apparatus						
(a) Desire					Increased	Decreased
(b) Erections					Priapism	Disturbing
(d) Ejaculation					Present	Imperfect
(e) Sensation					Dripping	Reversed
before					Satisfactory	Depressing
or					Unsatisfactory	Diagnos
after					coitus	Pain



(d)	Functional Disturbances					
	(a)	Nervous System	Depression			
		Neuroses				
		Melancholia				
		Exaltation	Hypochondria			
		Indifference	Irritability			
		Sleep	Normal	Interrupted		
	(b)	Gastro-intestinal System				
		Stomach	Flatulency	Breaking of wind		
		Liver	Large	Small		
		Intestines	Diarrhea	Constipation		
			PHYSICAL EXAMINATION.			
I.	General Appearance	Robust	Normal	Weak	Emaciated	
II	General Nutrition	lb.	Normal	Increased	Decreased	
III.	Anatomical Aspect					
	(1) Head					
	(2) Upper Extremities					
	(3) Chest					
	Heart	Normal	Abnormal	vis.		
	Lungs	Normal	Abnormal	vis.		
	(4) Abdomen					
	Flat	Bulging	above	below	umbilicus	
	Bladder	Inches	No			
	Groin	Adenitis	Yes			
	Scrotum	Normal				
	Testicle	Cord				
	Penis	Normal	Hypo	Epispadias	Discharge	
	Hemorrhoids					
	(5) Lower Extremities					
IV.	Prostatic Examination	(Painful reveals)	not painful)			
	(a) Digital	Hypertrophy	Hard	Soft	Spotty	Spongy
		Flat	Bulging	General or	(Circumscribed	Normal
		Round	Increase	Pulsating	Increase	Irregular
	(b) Instrumental	reveals				

V. Urinary Function

	Urine without straining	Turbid	Sour	Sweet	Amount
(a) 1st	Character Clean				
(b) 2d	Urine with straining				
(c) Residual Urine	Bladder Tone	Minus	Absent		
	Determined by Hard With	Soft Without	Blood	Catheter	
	Amount				

VI. Urethral Examination

(a) Length Penile	
Prostatic	
(b) Calibre	B.a.b.
Sound	Mercier etc.

(c) Endoscopy

VII. Bladder Examination

(a) Stone searcher
(b) Cystoscope

VIII. Urinalysis

	Rest	Exercise	body	sitz	Turkish
(a) Hygienic	Baths				
(b) Dietetic	Avoid etc.				
(c) Medicine	Diluents				Suppositories
(d) Massage					
(e) Mechanical	Psychrophor				
(f) Instrumental		leeches			rectal irrigation
(g) Operation					

TREATMENT.

IV. FORMER UROLOGICAL HISTORY.				Number and details of attacks		
(1) Cystitis				Number and details of attacks		
(2) Nephritis				Number and details of attacks		
(3) Albuminuria				Number and details of attacks		
FORMAL VENEREAL HISTORY.						
I. URETHRITIS.		W	M	Y	ago	Complicated with Ph. Para. Ad. Bal. Bul P. Complicated with Epi. Cy. Pr. Rh. J. Complicated with
1st Attack		W	M	Y	ago	
2d Attack		W	M	Y	ago	
3d Attack		Duration of 1st Attack				
2d Attack		2d Attack				
3d Attack		3d Attack				
Treatment of 1st Attack		Dr.	Disp.	Self	Injection medicine irreg.	
2d Attack		Dr.	Disp.	Self		
3d Attack		Dr.	Disp.	Self		
II. Chancroid					Durat	Treat
III. Warts		g.	s.	j.	Durat	Treat
IV. Herpes		g.	s.	j.	Durat	Treat
V. Psoriasis		g.	s.	j.	Durat	Treat
VI. Eczema		g.	s.	j.	Durat	Treat
VII. Syphilis		g.	s.	j.	Durat	Treat
Duration		•				
Incubation						
History						
Sore on Glans		Shaft	Junction	Scrotum	Belly	Body
Treatment						
Dr.		Disp.	Injection	Druggist	Injection	Self
Method.						
Ingestion						
Results to date		Fumigation				

## SUBJECT HISTORY:

Duration	D W M Y Ago			Noticed		
(a) Urination						
Increased daily	Frequency	Now q	h	Formerly q	h	
Increased nightly	Frequency	Now q		Formerly q		
Change in Stream	Large	Large	Small	Forked	Dribbling etc.	
Change in Quantity	Large	Large	Small			
Change in nature of act.						
Urgency	Complete	Incomplete	Involuntary			
Control	Quick	Slow	Dribbling	Obstructed	Interrupted	Suppression
Shutting off	established	yes	no	D	W M Y Ago	
Catheterisation						
(b) Symptoms (Urinary)						
(a) Subjective						
Pain in:	Penis (Glans Shaft Root)	Bladder	Testicle	Groin	Cord	Rectum Perineum
(Fulness throbbing)	Referred pains	Hypogastric	Lumbrosacral	Sciatic etc.		
Time of Pain	Before	During	After			
Frequency of Pain		Duration	Degree			
(b) Objective						
Discharges						
Urethral	Thin	Scanty	Copious			
Blood	Mucous	During	After			
Gravel	Sand					
(c) Disturbances of Sexual Apparatus						
(a) Desire	Increased	Decreased	Absent	Variable	Impotent	in Toto
(b) Erections	Priapism	Disturbing	Painful	Absent	Normal	
(d) Ejaculation	Present	Absent	Imperfect	Inefficient	Premature	
	Dripping	Decreasing	Reversed	Nocturnal	Emissions	
(c) Sensation	Satisfactory	Unsatisfactory	Depressing	Disgust	Pain	
	before	or	after	coitus		

the respective line of that treatment. As an example, phosphaturia is inserted as a symptom and hydrochloric acid as the treatment thereof.

Name..... Date.....  
Symptoms and treatment..... Dates of treatment.....

Phosphaturia  
HCl dil. drops

Such are the principles on which are based the general indications, special indications, contraindications, cautions and records of cystoscopy. If the beginner follows this painstaking and thoroughgoing plan he will find that his knowledge gains in accuracy and his cases in facility of classification and reference.

### HISTORY OF CYSTOSCOPY.

**The Cystoscope.—Development.**—A full epitome of this subject is that of Lewis.<sup>1</sup> The optical principles of the cystoscope are referred to works on physics and to special details in manufacturers' catalogs. In 1807, Bozzini, of Frankfort, combined a metal tube reflector and candle for examining the bladder. Brueck, of Breslau, about 1867, applied the incandescent platinum loop for "stomatoscopy"—examination of body cavities. In 1877 Nitze applied the incandescent electric light to the first real cystoscope. The greatest refinements and improvements in the instrument have been made in America.

**Types.**—The subdivisions respect primary and secondary forms.

- I. *Primary Varieties.*—Respect uses and are: (a) Examination.  
(b) Catheterization  
(c) Operation.  
(d) Composite, universal or combined.

II. *Secondary Varieties.*—Involve structure and are:

1. As to means of vision: (a) Telescopic, having true optical telescopes with magnification of direct lateral anterograde or retrograde fields and inverted or erected images.  
(b) Tubular, having naked eye vision through the sheath, as in Kelly's cystoscope.
2. As to source of light: (a) Extrinsic, having lamp and head mirror.  
(b) Intrinsic, having lamp integral with the instrument.
3. As to object in field: (a) Inverting, having image reversed.  
(b) Erecting, having image as related to the bladder.

<sup>1</sup> Trans. Am. Urol. Assn., 1908, ii, 216.

4. As to position of field: (a) Direct or axial, having field directly before the observer.  
(b) Indirect or lateral, presenting field at right angles to the axis of the instrument.  
(c) Retroversion or retrograde, viewing field between the lamp and observer.  
(d) Anterovision or anterograde, embracing field beyond the lamp.
5. As to preparation of field: (a) Nondistending, without means of filling bladder except by catheter.  
(b) Distending, with air or fluid through inlet but without separate outlet.  
(c) Irrigating, having inlet and outlet faucets.

**Optical Principles.**—Telescopic cystoscopes have these characters. In the direct or axial vision instruments there is a straight line between the object and the eye, and magnification and definition are provided by lenses variously arranged and adapted.

In the indirect or lateral vision cystoscopes, the object is at right angles to the axis of the telescope and its image is transmitted to the eye by prisms and lenses suitably adjusted and combined.

In either type the image may be inverted as in older instruments, or erected as in later models. The former give larger, better fields.

Tubular cystoscopes are of the Kelly type, without lenses, but with axial vision directly through a tube.

**Examination Cystoscopes.**—*Construction.*—Examination only is afforded by these instruments. The best models are of American design, consisting of a sheath with small incandescent lamp at the beak, electrical equipment and switch, irrigating faucets and telescope separable from the sheath. Subcaliber cystoscopes for children and obstructed cases are practically the only instruments of this type.

Practically all catheterization and composite types have at least two telescopes, one for examination and the other for other uses.

**Catheterization Cystoscopes.**—*Construction.*—Again the best models are the American makes which were the first to introduce double catheterization telescopes. In addition to the separable sheath and its obturator the essential is a telescope of reduced caliber and size for space required by grooves for the ureteral catheters. A director, operated with a thumb screw near the eye-piece, is placed at the objective lens for pointing the catheters into the ureters. Single catheterizing cystoscopes are essentially subcaliber instruments in which there is room for only one catheter. They are available for children and obstructed urethræ.

**Operation Cystoscopes.**—*Structure.*—All the features duplicate those of catheterization instruments, but the telescope is smaller to permit the passage of such instruments as: rongeurs, scissors, dilators, snares and electrodes.



**Composite or Universal Cystoscopes.**—*Construction.*—As the term implies, one telescope is used to receive all forms of telescope, axial and lateral field, anterograde and retrograde field examination, double catheterization and operation types.

*Accessories.*—These are the instruments stated under operating cystoscopes. The universal cystoscope of Lewis<sup>1</sup> is one of the most serviceable. The one sheath and two telescopes furnish direct and indirect observation; direct and indirect double catheterization up to size 8 or 9; direct and indirect application of all intravesical and intraureteral instruments. The operating telescopes become double catheterizing telescopes by applying a double-barrelled fin.

*Advantages.*—(1) Adaptation to size of the urethra; (2) sterilization by boiling; (3) cleansing of the ureteral mouths before catheterization; (4) adaptation of catheters to size of ureteral mouths; (5) waxed-tip catheters readily employed; (6) minor operations directly done; (7) urethroscopy during withdrawal.

*Disadvantages.*—(1) Extrinsic illumination; (2) limitation to female; (3) difficulty of genufacial posture; (4) general anesthesia common; (5) insufficiency of air dilatation; (6) field reduced to diameter of tubes; (7) greater difficulty of use. The Elsner and Braasch tubular cystoscopes are models largely on Kelly's.<sup>2</sup>

**Urinary Segregators or Separators.**—*History.*—The development of segregators corresponds with that of catheterization cystoscopes.

*Types.*—The Harris<sup>3</sup> instrument has largely been replaced by that of Luys,<sup>4</sup> whose components are omitted because so familiar.

The composite instrument is the most serviceable because it combines all four common uses in being a telescopic, intrinsic illuminating axial, lateral, retrograde and anterograde vision and irrigating model.

**Tubular Cystoscopes.**—*Types.*—Kelly's cystoscope is the prototype, consisting of a set of tubes, obturators, lamp, head mirror, ureteral catheters, and other accessory instruments. Its features *in situ* are clearly shown in Fig. 198.

*Accessories.*—The usual list is stated under operation cystoscopes and presented in Fig. 182. Of special value are the Lewis<sup>5</sup> ureteral dilator and fulgurating blade shown in Figs. 187 and 188.

The ureteral dilator illustrates several stages of use in stricture and stone. It is very efficient as high as five or six inches up the ureter; beyond this limit the ordinary bougies are safer.

The fourth illustration shows its traction on a stone. Older tractors (bristle probangs), become useless after one or two trials. The Cunningham<sup>6</sup> ureteral catheter is of little service as a telephonic detector but much as a dislodger.

<sup>1</sup> Am. Jour. Urol., 1906, ii, 598.

<sup>2</sup> Kelly: Johns Hopkins Hosp. Bull., 1893, iv, 101.

<sup>3</sup> Jour. Am. Med. Assn., 1898, iv, 274.

<sup>4</sup> Assn. franc. d'urol. (1901) 1902, v, 528.

<sup>5</sup> Personal communication to author, July 19, 1917.

<sup>6</sup> Jour. Am. Med. Assn., 1909, lii, p. 1331.

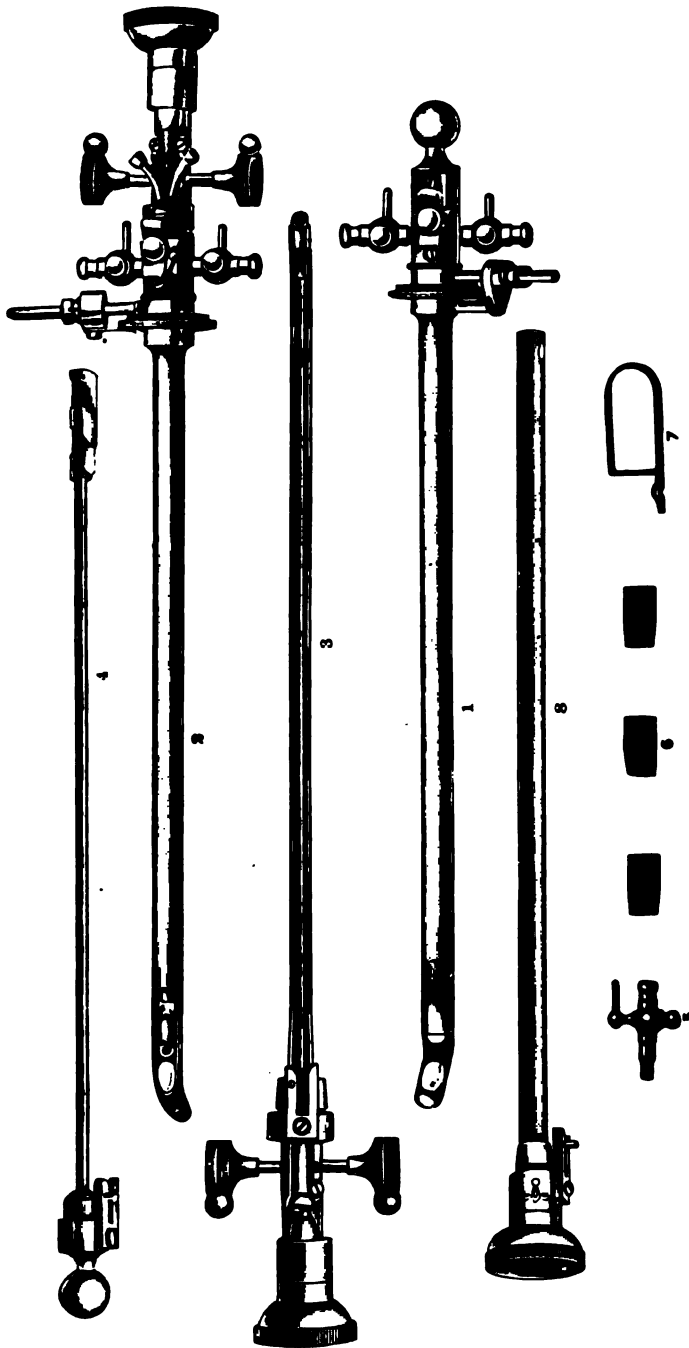


FIG. 182.—Buerger irrigating catheterizing and operating cystoscope. (1) concave sheath and obturator; (2) convex sheath and telescope; (3) indirect operating and catheterizing telescope; (4) patented obturator; (5) irrigating stop cock; (6) large rubber telescope tips; (7) catheter clip; (8) observation telescope. (Courtesy of Wappler Electric Company.)

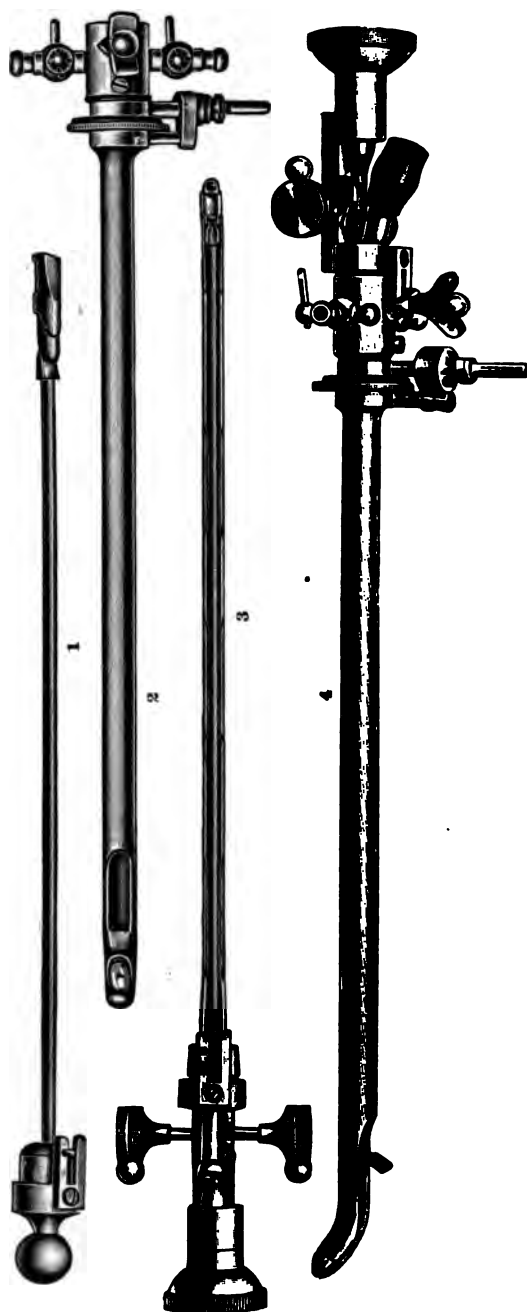
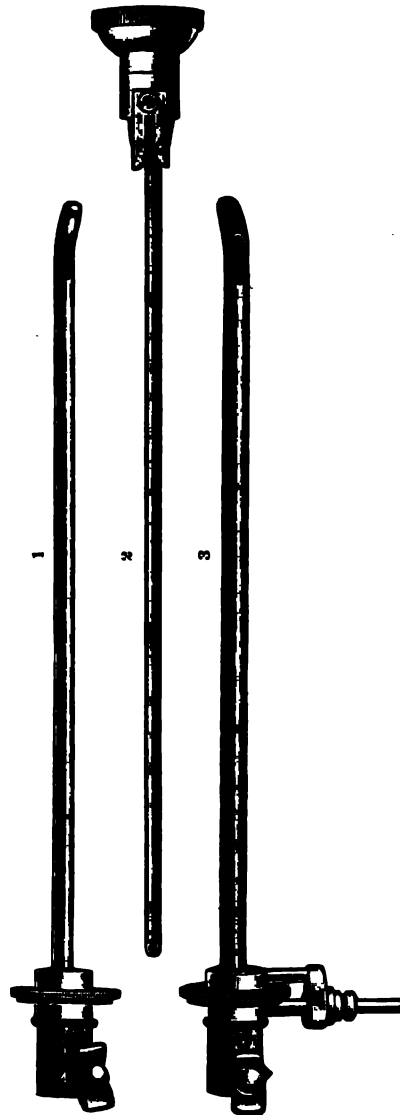


FIG. 183.—Buerger single catheterizing cystoscope. (1) obturator; (2) convex sheath; (3) telescope; (4) convex sheath and telescope ready for use. (Courtesy of Warner Electric Company.)



184.—Acmi subcaliber cystoscopes. (1) concave sheath; (2) obturating telescope; (3) convex sheath. (Courtesy of Wappler Electric Company.)

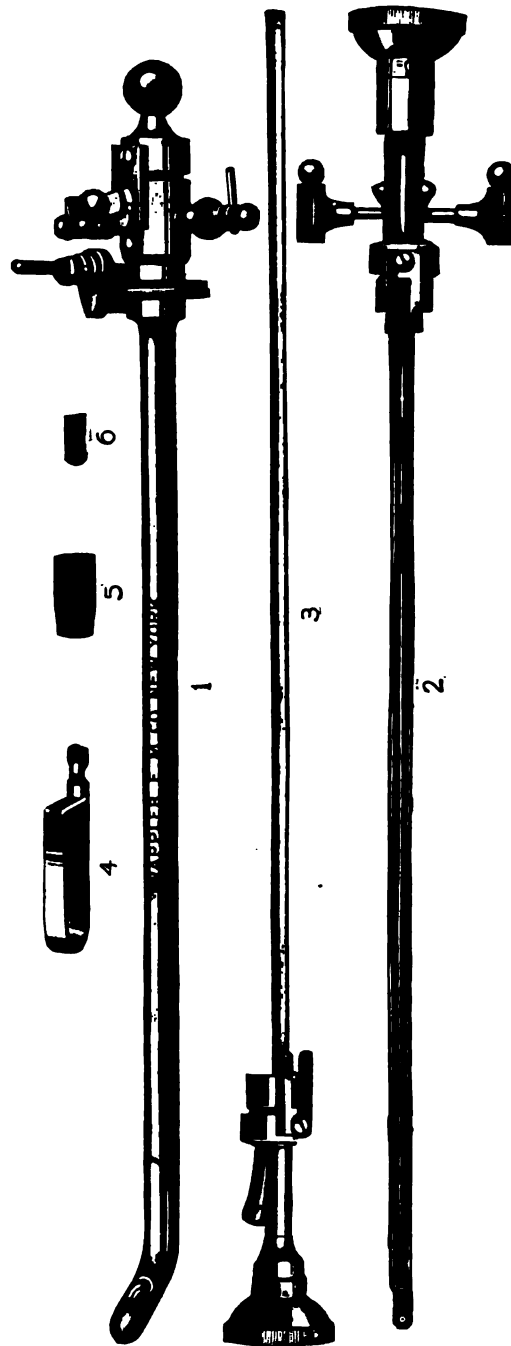
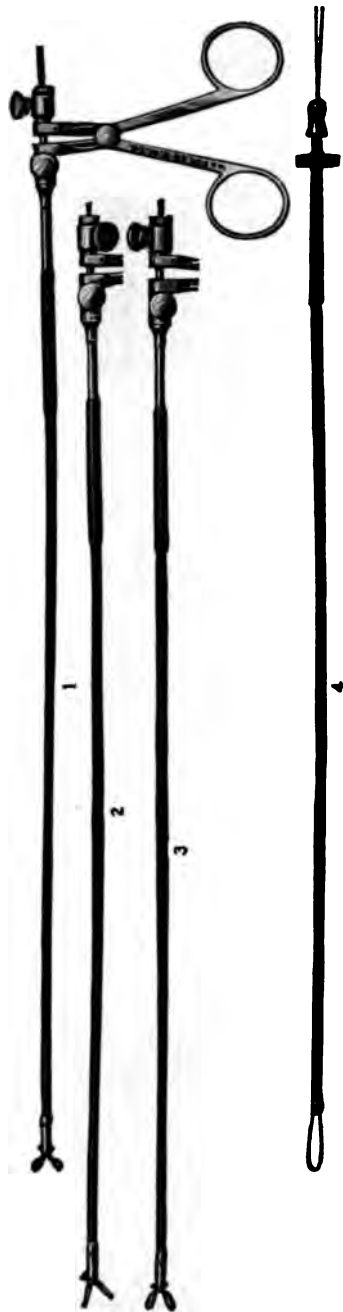


FIG. 185.—Bransford Lewis universal and operating cystoscope. (1) common sh with obturator in place; (2) indirect catheterizing telescope; (3) direct operating or indirect catheterizing telescope; (4) catheter clip; (5) operating cystoscope rubber catheter (6) plain catheter rubber tip. (Courtesy Wappler Electric Company.)



186.—Operating forceps and snare. (1) Rongeur forceps; (2) scissor forceps; (3) foreign body forceps; (4) Buerger's snare. (Courtesy Wappler Electric Company.)



Figs. 188 to 190 show the application of the Lewis<sup>1</sup> fulgurating blade and telescope to contractures of the vesical neck and allied conditions. It is effective, and safer than the rongeur of Young<sup>2</sup> and similar instru-

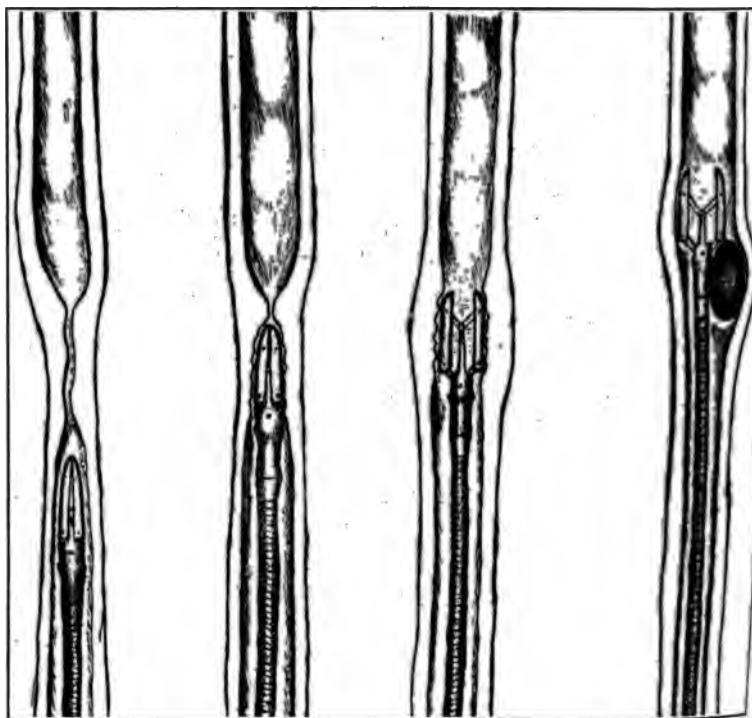


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 187.—Ureteral dilator. (1) Dilator in strictured ureter. (2) Dilator entering stricture. (3) Dilating stricture. (4) Making traction on a stone in the ureter. (Lewis.)

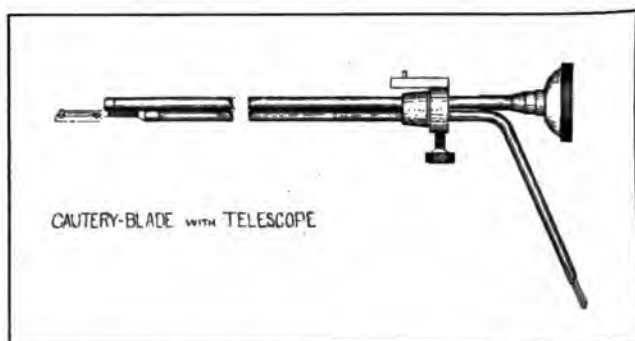
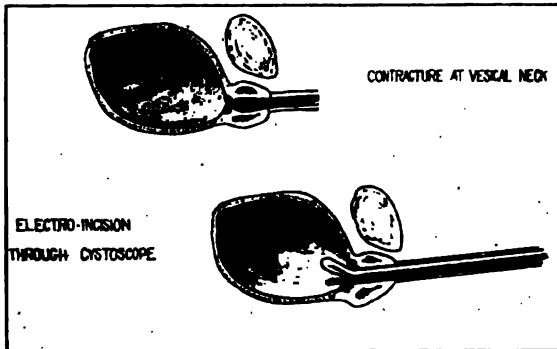


FIG. 188.—Cautery blade and telescope for use in cystoscope sheath.

<sup>1</sup> Loc. cit.

<sup>2</sup> Loc. cit.

which often cause hemorrhage. Lewis states that this blade no hemorrhage, fever or reaction and leaves the patient ambulant.



9.—Contracture of vesical neck (above) and application of cauterizing blade to it (below):



10.—Contracted neck before cauterization (left) and after cauterization (right).  
Figs. 188-190.—Fulgurating blade and telescope. (Lewis.)

### EQUIPMENT FOR CYSTOSCOPY.

Complete equipment includes besides the stock of various essential accessory instruments their storage, care and sterilization, primarily and secondarily the selection of the proper outfit for a given case, naturally respects instructions for the nurse in preparation of the patient and the supplies for the cystoscopy.

**Accessories.**—Accessory instruments of the equipment for cystoscopy embrace the lighting apparatus, the irrigating appliances, the urethral catheters, the instruments for intravesical treatment and the frequency electrical outfit.

**Uses of Light.**—Apparatus for furnishing light is either a controller utilizing the standard 110 volt direct current; or a transformer for changing the alternating to the direct current and then reducing the voltage by a set of dry batteries, wet cells, or a storage battery: all with a rheostat for management of the current. Thus within the will of the operator the strength of current passing through the lamp of the cystoscope is adapted to its capacity.

<sup>1</sup> Loc. cit.

Portable dry-cell outfits have been so perfected as to constitute the most convenient source of light for cases in which it is not possible to use dynamo current. In general, however, the latter is by far the better means of illumination, with the aid of the controller for direct current and the transformer for the alternating currents.



FIG. 191.—Cystoscopic portable equipment. The cotton flannel instrument case contains a selection of cystoscopes, cables, guards and lubricant; from left to right are the catheter and syringe boxes, rheostat and lamp, vesical and urethral syringes, boxes containing rubber caps, finger stalls and pins; behind these are the author's and alypin anesthetic lubricant, styptic powder and argentide and a pair of rubber gloves, leggings, draperies and rubber gloves. (Author's.)



FIG. 192.—Cystoscopic portable equipment. All supplies shown in the illustration have been rolled in sterilized towels and sterilized with the beam of ultraviolet light for several hours in nascent formaldehyde gas. (Author's.)

Controllers for direct current are made by various manufacturers, but both the direct and alternating systems may be employed interchangeably. In general form they resemble the standard lamp controller, with a body about four inches long. On this is wound a high-

coil, whence a shunt current is derived. Danger does not result from short circuiting of the wires coming from the controller; but no contact must be made with any metal conductor leading to the ground, such as radiators and water pipes. As one of the wires from the main is connected to the ground, the one touching the radiator may happen to be of opposite polarity and blow out a fuse or damage the instrument.

Wide ranges of current may be had with these controllers. Usually with a 16 c. p. resistance lamp in the socket a current of 0.3 ampère and from 0 to 25 volts may be obtained at the binding posts; and with a 32 c. p. resistance lamp a current of 0.8 ampère and from 0 to about 40 volts may be had. A rack and pinion or similar movement increases the voltage by steps of a third-part of one volt at a time. The resistance lamps should be dark in order to shut out the light during examination as much as possible.

The transformer for alternating current should be ground-free so that the possibility of shocking the patient is corrected. There are several first-class transformers of this type on the market. Inasmuch as they require no resistance lamp they are specially valuable in maintaining darkness during the examination, and in avoiding breakage of resistance lamps, which immediately cripples the operator unless another lamp is available.

The controller base of the author is valuable for private house work<sup>1</sup> in that the long cord allows one to connect with wall socket or electric plug at a great distance from the bed or table, and therefore to use only the standard six feet of small twin cable between the controller and the cystoscope. The other advantages of this controller base are set forth in the original article as follows:

**Irrigating Appliances.**—Irrigating appliances embrace those necessary for the nonirrigating cystoscopes and those for the irrigating cystoscopes. At least in the United States few really modern instruments do not provide irrigation at all times during the cystoscopy. Should this form be the only one available, then a full set of the various types and sizes of soft-rubber and lisle-thread catheters must be in hand for selection according to the case. With the irrigating cystoscopes a good hand-syringe of about 150 c.c. capacity and a rubber connecting tube about 4 feet long as a link between the cystoscope and the syringe are necessary. A rubber cap for the syringe is convenient for making watertight the joint between syringe and sheath when it is necessary to flush out the bladder actively with the telescope out. In office work an irrigating jar may be the source of water supply, but is not so good as the hand syringe in the hand of an assistant, which permits appreciation of the reaction of the bladder under distention; whereas the pressure of water from the irrigating jar is "dead" or more or less indeterminate to the operator. Ureteral catheters are at the present time of one approved type determined by the tip, which instead of being conical or olive as formerly,

<sup>1</sup> Jour. Am. Med. Assn., 1913, lx, p. 182.

is now rounded and cut obliquely for the end opening, at the expense of about a half-diameter and a half-centimeter of length. Opposite this end opening, and occupying about the other half of the first centimeter, is the first lateral opening; while the second lateral opening is opposite the first and in line with the end opening, and occupies the second half of the second centimeter. Thus the three openings are limits of the first two centimeters of length and spaced about a half-centimeter apart. Ureteral catheters are made of woven silk or lisle thread with carefully varnished surface and with the centimeters of length shown by yellow and black or yellow and red stripes, each a centimeter wide. The number of centimeters of length introduced into the ureter is sometimes shown by small stripes spaced as follows: one narrow stripe at five centimeters, two at ten, three at fifteen, and four at twenty centimeters; one wide stripe at twenty-five, one narrow at thirty, two narrow at thirty-five and three narrow stripes at forty centimeters. Thus it will be seen that all the stripes are narrow excepting that at twenty-five centimeters, so that one may easily know the distance above or below that figure at which the tip of the instrument lies. The proximal ends of most catheters are now made conical to receive a syringe nozzle conveniently; but such conical ends prevent withdrawal of the cystoscope, leaving the catheters in place; hence it is better to cut them off and connect the catheters with an aspirating needle deprived of its point and fitting tightly into the caliber of the catheter.

Special ureteral catheters are varnished so as to be opaque to the *x*-ray. These are known as shadow or *x*-ray catheters and have a very great advantage in that the opacity obviates the necessity of passing wire stilettes through the catheters which is at once painful and somewhat dangerous to the patient.

Another special form of ureteral catheter is the stone-searching or telephonic catheter consisting of a wire with a conical head about 5 F. in diameter forming the tip of a size 3 F. catheter; so that the wire passes through it from end to end and terminates in a little glass earpiece designed to rest in the ear of the operator and make it possible to hear the grating of the metal tip upon the stone.

A good series of catheters for the expert to possess is one each of sizes 3 F. to 7 F., both inclusive, of the yellow and black and yellow and red standard markings; two size 5 F. *x*-ray catheters, or a similarly full set of them, sizes 3 to 7 F.; two telephonic catheters size 5 F.; and several soft phosphor bronze wires as stilettes when needed. Stilettes must not bind within the caliber of the catheters.

The instruments for intravesical nonelectrical treatment have been sufficiently portrayed in the preceding pages under the heading of operation cystoscopes, with the exception, however, of one serviceable instrument, the McCarthy flexible forceps. It consists of a flexible coiled wire sheath through which a small alligator forceps passes to the handle, at which a spring thumb-attachment permits the operator to open and close the jaws. The handle of the instrument is of the form standard for most surgical implements and is placed at right angles to



a shaft, from which it is detached by two thumb nuts. A small thumb nut on the handle itself permits the jaws to be held closed in a convenient position. It is designed for use in the Acmi operating and etherizing cystoscope and may be directed with the facility of an ordinary ureteral catheter. Its action is strong, positive and satisfactory in a properly chosen lesion.

Several genuine whalebone filiform guides, two feet long, size 3 to 4 F., could be in the armamentarium, available for the method of stone arching described by Burton Harris, consisting briefly in coating the last two centimeters with melted beeswax and resin, which is scratched in contact with the ureteral stone. The technic of preparation and use will be detailed on page 839, under the subject of ureteral calculi. The high-tension electrical machines in the accessory equipment for cystoscopy are either portable or stationary. The stationary machines vary in strength from those producing the standard Oudin current to those developing the Oudin, the d'Arsonval and other complex currents of high potentiality, including those for x-ray photography. With such instruments general electric therapeutics may now be applied. The portable high-tension machines consist of a primary transformer or motor dynamo in one box, and in a second box the various devices for developing and controlling the Oudin and d'Arsonval currents. Each case weighs nearly fifty pounds but is, nevertheless, manageable for a strong man. All ranges of ordinary cystoscopic treatment may be reached with this portable outfit but is not suitable for electrotherapeutics except within very limited degrees.

**Storage.**—The equipment for cystoscopy is most conveniently provided for by a suitable instrument cabinet on the shelves of which are classified the various essential and accessory instruments and supplies. The cabinet of the writer is arranged as follows:

**SHELF I. Dressings:**

- Sterilized cut gauze.
- Sterilized gauze wipes.
- Sterilized towels.
- Sterilized special towels.
- Rubber gloves.
- Rubber finger stalls.
- Rubber bands.

**SHELF II. Chemical Supplies and Glassware:**

- Special glasses and specimen bottles for urine.
- Graduates in full assortment.
- Glass urethral syringes.
- Two syringes with needles for intravenous injection.
- Phenolsulphonephthalein.
- Indigocarmine.
- Cocain powders, grain 1.
- Eucain powders, grain 1.
- Alypin powders, grains 5.
- Alypin solutions, 2 per cent. and 4 per cent.
- Sterile olive oil.
- Hemostatic powders.
- Colorimeter with extra glass prism, Hypodermatic syringe.
- Colorimeter card.
- Lubricants—Irish moss jelly, Vaseline and Boroglyceride.



**SHELF III. Cystoscopes and Urethroscopes:**

Otis' Examination Cystoscope.  
 Buerger Cystoscope with examination, retrograde and catheterism telescopes.  
 F. Tilden Brown Direct Vision Catheterism Cystoscope.  
 Follin Cabot Direct Vision Catheterism Cystoscope.  
 Buerger Cystourethroscope.  
 V. C. Pedersen's Light Carrier and Magnifying Lens for the Buerger Cystourethroscope.  
 Box containing extra lamps, binding posts, faucets, deflectors, grease, pins, etc., for cystoscopes and urethroscopes.  
 Knife, curette, probe, scissors and applicators for vesical and ureteral treatment.  
 Rubber guards against splash and high-tension short circuit.

**SHELF IV. Accessories:**

Standard ureteral catheters, 3-7 F. inclusive.  
 X-ray ureteral catheters, 5 F.  
 Stone searching ureteral catheters, 5 F.  
 Rubber catheters in full assortment.  
 Lisle-thread catheters in full assortment.  
 Harris' filiform guides and wax;  
 V. C. Pedersen's rheostat and switchbase.  
 Hand syringes—250 c.c., 150 c.c., and 100 c.c. capacity.  
 Standard direct-current controller with 16 c. p. and 32 c. p. resistance lamps.  
 Alternating-current transformer.  
 Cables for cystoscopes (duplicates).  
 Cables for urethroscopes (duplicates).  
 Glass immersion jar.

**SHELF V.**

Complete outfit for salvarsan intravenous injections.  
 Surgical basins.  
 Dark field illuminator.  
 Chismore evacuation tubes, bottles and bulbs.  
 Proctoscopes with electrical equipment.  
 Lithotrites.  
 Formaldehyde generating lamp.

The special towels spoken of above measure about 30 inches long by 20 inches wide. Six inches from one end a buttonhole about 2 inches long is worked through which the cystoscope passes into the urethra of the male or female and through which only the penis projects. The loose part of the towel is gathered gently around the genitals and buttocks of the patient, thus insuring protection against contact and the disagreeable odor which is almost invariably present. Privacy for the patient is also secured most conveniently.

The rubber guards against splashing and high-tension short circuits are made of black rubber packing about an eighth of an inch thick, 4 inches square, through the center of which a hole is made—a tight fit for the cystoscope or loose for the fulgurating wire. When in place this guard receives any unexpected spurt of bladder or urethral contents, thus thoroughly protecting the operator. The fulgurating wire passing through one of these guards is held in the hands of the operator's assistant, or sometimes by the patient himself so that the high-tension wire is not touching anywhere. This in itself prevents short circuiting. Likewise at times contact between the genitals and the coupler may cause short circuits there, which are prevented by having such a guard over the urethroscope or cystoscope.

The lamp for generating formaldehyde gas is of the standard type and housed in a tin box without the cover and stood on end—thus

serving as a protection against the heat of the lamp which might crack glass or ignite wooden shelves. The practice of the author is to have this lamp generate the gas whenever the cabinet has been opened for more than a very brief moment. Repeated interrupted sterilization of the entire contents is provided for in this manner very adequately.

The ureteral catheters may be stored in long glass tubes, which if corked should contain one or two formalin wafers for incessant sterilization. Or the catheters may be kept coiled in boxes of sufficient size, about 6 inches square, so as not to curve the catheters too sharply. If the boxes are kept covered, formalin wafers should be inside also. The urethral catheters had best be kept flat on the shelves subject to air drying and the influence of the formaldehyde. The matter of air drying is very important as it prevents sweating of the catheters and consequent deterioration. The author, therefore, prefers not to cork or cover any of the catheters and feels that boxes for ureteral catheters have the advantage over tubes of permitting more ready transportation.

The immersion jar named among the accessories is an ordinary wide mouth prune jar with a bridge having several holes through which the urethral instruments are suspended in a fluid antiseptic; thus the eyepieces are not wet and the hands of the operator are kept out of such inconvenient media as 5 per cent. carbolic acid water. In an emergency a pitcher may be similarly employed, so that the wooden bridge is the real essential.

There are special urological instrument cabinets made with small sockets around the wall of one space corresponding with the general position of one shelf. In these sockets are suspended the various cystoscopes, urethroscopes and other instruments, with the purpose of affording contact of the formaldehyde gas with the entire surface of the instrument which penetrates the body, both urethra and bladder, for example. This is an attractive refinement but not an essential; a urethral instrument thoroughly and properly cleansed may perfectly well be laid on a shelf for action of formaldehyde.

**Sterilization of Equipment for Cystoscopy** is absolutely important and must be carried out to the last degree of care. It includes not only the instruments themselves and the operative field, but the urinary excretions so far as possible through the preliminary administration of any efficient urinary antiseptic, so as to minimize the possibility of growth within the bladder or urethra of any organisms inadvertently introduced.

The means of sterilization are gaseous, fluid and mechanical. Formaldehyde is the best gaseous sterilizing medium and is most conveniently supplied by generating lamps and wafers within cabinets and other instrument containers. All parts of instruments should be separated, none assembled, in order to permit full contact with the gas.

The fluids ordinarily employed for sterilizing cystoscopic equipment are 95 per cent. carbolic acid, 5 per cent. carbolic acid, 95 per cent. alcohol, 4 per cent. boric acid and sterile water. It should be remem-

bered that concentrated carbolic acid is an oily, clinging fluid, insoluble in cold water, but soluble in alcohol, with which it should therefore be washed off the instruments to escape its caustic effect. Alcohol attacks the varnish of all woven instruments and sometimes the cement used to fix lamps, lenses and prisms, hence it should not be used except for mopping and rinsing them. Whatever chemical is employed final immersion in plain sterile water is advised. Acid and alkaline media are similar to alcohol in action.

The mechanical sterilization of the equipment for cystoscopy varies with metal and nonmetal instruments. The metal instruments, including cystoscopes and urethrosopes, should be taken apart so that their mechanical and optical elements may be sterilized individually. They should be first subjected to a stiff brushing with green soap and water, and all blood, pus, detritus and other foreign matter carefully removed to avoid coagulation and caking through the gaseous and chemical agents. Tubular parts of instruments should be flushed with water under pressure and carefully swabbed with cotton or gauze on special applicators or with pipe cleaners—in short, they deserve the same care as rifle barrels. If the tubular portions do not carry the electrical or optical systems they may be boiled with the plain instruments.

All moving mechanical parts and joints should be lightly lubricated with sterilized oil after the mechanical cleansing and drying.

The electrical and optical portions of urological instruments cannot be boiled or treated with the stronger chemical antiseptics. They should, therefore, receive stiff brushing with soap and water, then with 5 per cent. carbolic acid water, next flushed under pressure and swabbed or mopped with 5 per cent. carbolic acid water. After which excess of water should be shaken off and the surface dried as much as possible and finally, without assembling, all the parts should be shelved and exposed to formaldehyde gas.

The foregoing details are available for cases giving the operator control of his own time. In emergency or rush cases, however, the following details are serviceable: thorough mechanical cleansing, boiling of all possible parts for five minutes, immersion in 5 per cent. carbolic acid water for ten minutes, followed by thorough flushing and rinsing with 95 per cent. alcohol and then with sterilized water; if preferred they may be bathed in 95 per cent. carbolic two minutes, followed by the same treatment with alcohol and water as just stated.

The catheters, which include both urethral and ureteral, are sterilized substantially in the same manner. Hard flushing with water should be employed to remove blood, pus, detritus and other foreign matter. If the case has been infectious syphonage may be employed for ureteral catheters. This is carried out as follows: Any large vessel is filled with sterilized water and the catheters suspended over its edge so that their eyes just clear the bottom; they are then sucked full of water with a hand syringe, placed in the proximal end which hangs over a receiving basin; thus slow syphonage drops through the catheters for several hours, soaking them clean. Sterile water used in this way may be

lowed up by mild antiseptics for a brief period, as strong chemicals and long exposure deteriorate the varnish. Five or 10 per cent. formalin is about the most serviceable for this purpose. Formaldehyde gives the final touch.

In emergency and hurry cases on the same day ureteral catheters could be soaked in sterile water for ten minutes to soften any adherent foreign matter; then scrubbed with soap and a stiff brush thoroughly; then flushed under pressure under sterile water; which is followed by either 10 per cent. formalin or 5 per cent. carbolic acid water; in turn followed by sterile water again. These catheters may be boiled a number of times in water free of alkali, provided the temperature is slowly raised to the boiling point. If they are plunged suddenly into boiling water the varnished surface is almost immediately spoiled. It is worth noting that alcohol, acid and alkaline mediums also damage the varnish materially.

Rubber catheters and other rubber goods may be boiled in water free of acid or alkali, after, of course, thorough cleansing in the manner previously suggested. If nitrate of silver has been used in catheters these should never be boiled with metal instruments as the silver discolors in black spots upon the nickel surface.

Soft-rubber catheters are apt to lose all rigidity by frequent boiling. When this undue softness begins to appear it may be very largely remedied by giving the catheters a "rest cure" which consists of substituting others for them while they are permitted to dry thoroughly in air and thus resume their former stability. In this manner the life of good rubber catheters may be materially prolonged.

**Lubricants.**—Lubricants in the equipment for cystoscopy are selected with respect to the instruments and the mucous surfaces. They should therefore have the following characteristics: semifluidity, non-irritation, antiseptic, non-irritation, water-solubility, transparency, translucency, chemical stability. Only three lubricants fulfill all these requirements, namely—sterilized glycerin, boroglyceride and catheterpurin. All are available for urethral, vesical and vaginal lubrication. The writer favors boroglyceride because it is antiseptic, normally antiseptic and universally procurable. The formula for catheterpurin is as follows:

Oxycyanide of mercury . . . . .	3½ grains	0.21 grammes
Glycerin . . . . .	5½ drams	22.00 grammes
Tragacanth . . . . .	46 grains	2.76 grammes
Sterilized distilled water . . . . .	3 ounces	93.00 grammes

Sterilized olive oil is the only true oil available in cystoscopic work and the sole purpose of instillation into the ureter above an impacted calculus, in the hope of assisting it in migrating into the bladder.

Preparations in cystoscopy are of little service as they do not fulfill the going prerequisites. Vaseline is best for finger cots during rectal examination of instruments into the bladder.



### PREPARATION FOR CYSTOSCOPY.

Preparation for cystoscopy comprises both the selection of the equipment for a given case and the preparation of the room, patient, essential and accessory instruments.

**Preparation of the Room and Patient** varies in accordance with the selection of office, hospital or home for the work and with the general character and symptoms of the case. As a rule in all cases possible it is well to give the patient a general body bath, evacuation of the bowels with cathartics and enema, as a loaded rectum renders introduction and manipulation of the cystoscope difficult and may greatly alter the appearance of the bladder floor. Water may be administered freely, unless contraindicated, as a stimulus of the kidneys, beginning about a half hour before the examination. Drugs are inadvisable as they may alter the chemical constituents of the urine; urinary antiseptics are, however, advantageous as a preventive against infection and other untoward results. Changes in the urine before and after their administration may readily be estimated.

In all male cases, moreover, the patency of the urethra up to 26 should be known provided such procedures as ureteral catheterism are to be carried out. Otherwise its patency up to 13 F. or 18 F. should be known for acceptance of the children's sizes of simple examination cystoscopes. Meatotomy may be advisable. General information concerning the prostate as to congestion, infection, neoplasm and hypertrophy should be fixed for the proper selection of instruments at treatment.

In female patients a preliminary vaginal douche is both convenient and a preventive against infection.

In all possible cases a twenty-four-hour specimen of urine should be collected and analyzed just before the cystoscopy. A general physical examination is also advisable in order to discover important lesions other than those of the urogenital tract, unless such facts have already been supplied by the family physician. Usually great nervousness when discovered is relieved by sedatives, the choice being bromids, codeine and in extreme cases, just before the examination, morphin or during a general anesthetic.

With some experts it is the rule to examine simple cases with urine in the bladder as the medium of distention, which requires the patient to hold his urine for several hours previously. The writer prefers clear water as the basis of distention so that the eye becomes accustomed to one medium which has as little effect as possible on the color of the mucous membrane. The urine varies so widely in color as to materially change the picture at times.

The difficult cases for cystoscopy are those which show hemorrhage and great irritability of the bladder. They require rest in bed; for the blood such means as adrenalin, astringents and hemostatics; and for the irritability local anesthetics such as solution of alypin (2 to 4 per cent) retained in the bladder, or eucain and cocain applied to the urethra.

is injected into the sacral canal for "blocking" the sacral nerves. Local anesthetics are a last resort in these cases. Adrenalin may be of benefit by internal administration for hemorrhage.

There is another element in different cases which, like blood, requires to be removed and thorough flushing and irrigation of the bladder for its removal. Excepting when the bladder is highly irritable it is best to continue this washing until the return is absolutely clear, so that the mucous membrane will be as clear as possible to inspection.

In all cases the prerequisites are those of a laparotomy and involve the preparation of the room, cystoscopist, assistant and nurses, equipment and field.



Fig. 23.—Semidrawer leggings. The free access to the sexual organs, perineum, anus and thighs are clearly shown.

**Dressing and Draping the Patient** are largely matters of taste for the cystoscopist or training of the nurse in charge. The writer finds it convenient to dress males and females precisely as one does the patient for a pelvic operation. Namely, sterilized large bag leggings are pulled over the lower extremities and extended to the waistline, of



muslin for summer and flannel for winter service. In addition to these, the special buttonholed towel previously described covers the abdomen and lower thorax, with the opening over the genitals and the short tail gathered about the buttocks and anus. Other sterilized towels may be spread over the leggings if desired. In the foregoing manner as much privacy as possible and practically absolute asepsis are secured.

**Cystoscopy in the Professional Office** differs in no respect from that in a hospital and is in the ordinary nature of things the commonest manner of such examinations. In fact, it is hardly fair for any cystoscopist to accept the responsibility of the work unless his quarters are as complete as possible in equipment. In other words, his facilities must be adequate for all exigencies.

It is probably best to have a separate room devoted to this and other strictly aseptic work so that the room itself tends to aid in the prevention of infection. No plan is more convenient than that of the writer whose office floor is laid out in four rooms respectively devoted to consultation and preliminary examination, cystoscopy and urethroscopy, and the remaining two to ordinary treatment of pus cases. This plan is the means of saving all the time which each patient devotes to dressing and undressing—in a professional day readily an hour or more.

The final prerequisites therefore are alike in office, hospital and home cystoscopy: asepsis, antisepsis and sterilization. These are best maintained by a commodious instrument cabinet in which everything possible is stored and subjected to repeated interrupted sterilization with formaldehyde gas.

**Floor Plan.**—The floor plan for office cystoscopy is the same as for hospital work and is fully described under this subject, so may here be dismissed by saying that on the right of the operator stand the nurse and the table carrying, within easy reach of the nurse, everything for which she is responsible (for example, dressings, linen, jars, basins, irrigation outfit and the like) and carrying within easy access to the operator details for his probable needs—such as the equipments for illumination, examination, ureteral catheterization, treatment (instrumental, electrical and chemical). On the left of the operator stands the assistant in charge of such instruments as the nurse cannot properly manage also on a table, if desired, notably the fulguration generator and controllers. The writer prefers to have his assistant rather than the nurse take charge of such important matters as the specimens duly labeled in their various glasses, tubes and bottles, and of the local anesthetic for spinal or sacral, vesical, urethral and meatal administration as later discussed more fully.

One sometimes hears the statement that office examinations may decide a diagnosis sufficiently for proceeding with the detail of treatment and need, therefore, not be as formal as a hospital cystoscopy. This is certainly not true, especially if kidney conditions are even indirectly suspected. Such will indicate inevitably catheterism of the ureters, the efficiency test and every known form of diagnosis as much

in the office and home as in the hospital. It is true that simple inspection in the office or anywhere else may recognize such general conditions of the bladder as foci of tuberculosis, hemorrhage, pus and neoplasm but cannot possibly go any farther than this.

The other details of office cystoscopy are fully discussed in the immediately succeeding paragraphs dealing with this class of work in institutions.

**Cystoscopy in Hospitals** usually meets the ideals of every facility for full asepsis and antisepsis. There should be an adjustable table for securing the proper and comfortable position of the patient, a capacious one for the cystoscopes and accessories, and often a third for dressings if it is thought such will be needed.

**Cystoscopic Tables** are numerous and vary from the very complex and expensive to the simple, efficient and less expensive. The late Dr. F. Tilden Brown devised a very satisfactory complex table with which almost any known surgical position may be obtained. He also devised a pair of adjustable leg supports affording many of the simpler attitudes of the limbs and attachable to the ordinary household table.

The author has produced a very complete simple table which permits of all the cystoscopic and several of the more important surgical postures with ease and rapidity. One of its particular features is that the leg rests may be attached to the forward legs of the table and remain behind when the pelvis is raised, so that the thighs drop gently downward into a position of repose, for many patients far more easy than the lithotomy position. If it is desirable to use the latter position the rests may be attached to the center piece of the table and moved with it. For the lithotomy posture one of the most convenient leg rests is the knee crotch holder fitting behind the flexure of the knee so as to support both the thigh and the leg in a very comfortable, hollow receiver. The simple foot boards about 14 by 4 inches with a metal margin, and mounted on the same clutch as the gynecological footrest for clamping to the bars of the table, are most comfortable in that the weight of the limbs rests on the feet as wholes, which prevents the ankle clonus and other tremor often seen with the common stirrups.

**Postures for Cystoscopy.**—For simple rapid inspection of the bladder the top of the table may be left flat and the patient lies supine upon it with the lower extremities extended and separated. The observer stands at the side and stoops until his eye is in line with the cystoscope—a most uncomfortable position for him but a very easy one for the patient.

The genufacial posture is necessary for females if the tubular type of cystoscope such as Kelly's and Pryor's is to be used. This is manifestly a most difficult attitude for the patient to maintain for any long period. It therefore requires a general anesthetic and artificial suspension of the patient in this position for difficult and prolonged investigation.

The general posture for cystoscopy preferred by the writer is as follows: the pelvis is elevated until the eyepiece of the cystoscope is



opposite the eye of the observer without stooping, and until the table top is thus an easy steady rest for the forearms during manipulation of the cystoscope. The lower extremities are then placed in the lithotomy, exaggerated lithotomy or drooping position, entirely in accordance with the patient's comfort. The head piece of the table is raised so that the trunk and head are flexed on the pelvis until the head is high enough to prevent rush of blood into it. The upper extremities of the patient are laid across the chest under the sterile towels. This might be called the posture of moderate universal flexion which is known to be that of great comfort, ease and satisfaction.



FIG. 194.—Author's cystoscopic table adjusted for the posture of "universal flexion."

The full sitting posture or nearly sitting posture is also a very convenient one with a few restrictions. Serious difficulty arises if the patient starts to faint which is by no means an uncommon experience. Apprehensive patients may readily watch all that is going on and greatly augment their already undue fears by not understanding the simplicity of the various procedures.

**Instrument Table.**—This important furnishing should be sufficiently large to contain the essentials at the immediate right and direct reach of the operator, and the accessories of the cystoscopy at the opposite or nurse's end of the table.

The essentials alluded to comprise the means of irrigation, illumina-

nation, examination, ureteral catheterism, vesical treatment both instrumental and electrical. The latter therefore includes the generation, regulation and application of the Oudin and d'Arsonval currents when necessary.

The accessories under the charge of the nurse include the details of the dressings, the towels and the linen. To these may sometimes be added the full irrigation equipment which the nurse often operates under order from the cystoscopist.

The assistant stands at the cystoscopist's left for independent service of his needs and the patient's. The floor plan of a cystoscopic room is practically that of any other operating room.

**Nurse's Duties in Cystoscopy** should be submitted to written form and should cover at least the details hereinafter named: provision and preparation of the operating table; instrument table; hand basins of antiseptics; containers of sterile water and of 2 per cent. boric acid water; sterilized sheets and draperies; sterilized and common towels; sterilized gauze in handkerchiefs and balls; sterilized absorbent cotton in bulk and balls; glass graduates in full assortment; syringes in complete series for bladder, urethral and hypodermatic service; local anesthetics for urethral, vesical and subcutaneous application (alypin, cocain and eucain); urethral sounds and urethral catheters in sterile towels or the latter in tubes; a reasonable line of instrument trays, test-tubes, glasses and bottles for specimens; lubricants (preferably boroglyceride or a semifluid preparation of Irish moss); antiseptics for the field (by choice 10 per cent. silver nitrate solution for application and for irrigations styptics in suitable strength); test dyes, particularly ampoules of phenosulphonephthalein and indigocarmine.

The nurse should also prepare the field. The female nurse should douche the vagina and wash the vulva. The male attendant should cleanse the penis, scrotum and surrounding parts. Both should give the enema and see that the skin is clean from the knees to the navel in all directions unless a general body bath has been possible.

**Operator and Assistant**, when the nurse is ready with the foregoing duties performed, scrub up in approved fashion, remove the instruments from the sterilizer or containers, such as towels, bags or boxes, lay them out on the table, adjust the cables and test the connections, switches and lights. In their direct service for these points the nurse brings in the special sterilizers or containers, which she opens and presents so that everything remains sterile, including the cystoscopes, electrical equipments and other accessories and the like, and so that the operator and his assistant are not at all contaminated by touching anything that is not sterilized. The layout is then covered carefully with sterilized towels, the patient brought in and arranged on the table, then the nurse washes up very carefully, uncovers the instruments, whereat everything is ready for the cystoscopist to begin.

**Cystoscopy in the Home** includes supplies for which the family are responsible and the preparation of which the nurse and the operation must provide.



**Materials from the Family** include sterilized dry goods in full assortment, towels, sheets, gauze, cotton, rubber sheeting and table oilcloth, various utensils such as slop jar, hand basin, pitchers or bottles for hot and cold sterilized water, ironing board or table leaves for passing between the mattresses of the bed when a table cannot be provided, as much preferred. The examination may be done with equal accuracy either on the bed or on the table, but the bed is so low as to constitute a real obstacle for facile work.

**Details in Charge of the Nurse** vary in home work from those in office or hospital work only in the oversight she must have as to the duties of the family, otherwise they are identical.

**Instruments and Supplies of the Operator and Assistant** comprise either a universal or composite cystoscope, or a series of cystoscopes, especially a small examination, a direct catheterism and an indirect catheterism instrument, including a retrograde vision telescope. For female cases a set of Kelly's direct vision cystoscopes may be added in suitable cases. The full irrigation equipment of syringes and rubber tubing and the electrical layout of cables, batteries, transformer or control with resistance lamps, together with sounds for urethral exploration are included. Urethral and ureteral catheters, test-tubes, glass bottles and graduates for specimens are important, likewise drugs such as cocain, alypin, nitrate of silver and the lubricants.

**Arrangement of the Room** is exactly the same as in the office or hospital so far as the circumstances of the family and the general surroundings will permit.

**Floor Plan of the Room.**—For the instruction of nurses and assistants in a brief and definite manner as to furniture, dressings, utensils, instruments and similar supplies necessary for a cystoscopy, it will be found that a floor plan of the room, as a diagram and inventory, which contains most of the essentials will be of great convenience.



FIG. 195.—The cystoscopic field in the corrected image instrument. (Marion, Heitz Boyer, Germain.)

### TECHNIC OF CYSTOSCOPY.

Details of technic of cystoscopy respect the following points in addition to such as have been elucidated by the foregoing sections—

the position of the patient; the general and local anesthesia of the patient; preparation of the bladder; the standard management of simple cases, and of difficult cases; and the recognition of the causes of complications and failures in the examination.

**Postures of the Patient.**—Postures of the patients vary within the choice of most cystoscopists. The writer has found that the average patient is most comfortable for himself and most manageable for the examination when placed in what has been denominated a few pages back as the position of moderate universal flexion. This term means the dorsal decubitus posture with the trunk slightly flexed upon itself



FIG. 196.—Universal flexion posture for cystoscopy.

so as to bring the head above the level of the elevated pelvis, and with the lower extremities either in the lithotomy position or in the drooping position at each side of the operating table. In addition to this attitude of moderate universal flexion many cystoscopists elect the lithotomy or exaggerated lithotomy positions, with or without elevation of the pelvis, both of which are too well known to need further notation. The genufacial, otherwise called the genupectoral or knee-chest posture, is limited entirely to female cases, and among these only to those available for the cystoscopic tubes. The difficulties and disadvantage of this attitude for both patient and operator are obvious and have already been alluded to.



The sitting posture is one of great convenience if the patient's self control against fainting or other nervous manifestation is known, as it maintains the floor of the bladder in about the same position as it has when the patient is ambulant. It requires a table which may be converted into a chair with a generous back and side arms, a middle piece which is not longer than the thighs acting as the seat of the chair, and foot-rests which permit abduction of the thighs. The patient is then brought as near the edge of this "chair" as convenient so as to permit manipulation of the cystoscope. The difficulty of managing the instrument after its introduction with the patient seated is one of the obstacles to the sitting posture as well as the danger of syncope while



FIG. 197.—Lithotomy posture. The body is horizontal, the head elevated on a pillow, the perineum is at the edge of the table, the knees flexed on Bierhoff rests and the thighs well flexed upon the trunk. The pelvis may be elevated by raising the table top. The lower extremities may be strongly flexed upon themselves and the trunk constituting exaggerated lithotomy posture.

the attention of the operator is directed away from the general state of the patient.

The position of moderate general extension which is the converse of that of moderate universal flexion is helpful in nervous patients for simple inspection only. It is the dorsal decubitus posture with the lower extremities extended and widely abducted. The operator must twist and crane his neck to the level of the eyepiece from his position standing at the side of the patient. The great discomfort of this attitude combined with the fact that the table top limits the depression of the eyepiece within very narrow extent are the chief valid objections to this arrangement of the patient.

Changes in Posture of the Patient are frequently necessary for the purposes of improving the field and view of the bladder, of passing the ureteral catheters more readily, of reaching the pelves of the kidneys for lavage and hydronephrotic drainage and of employing radiography. Such alterations in the arrangement of the patient should be made without removing the cystoscope when possible. It will therefore be seen that the position of moderate universal flexion is the best because it permits the operator without removal of the cystoscope, to raise or



FIG. 198.—Cystoscopy in the female. Dorsal position, extreme elevation of the pelvis, fixation of the thighs by a sheet-roped passed around them back of the knees and below and behind the shoulders. (Kelly.<sup>1</sup>)

lower the lower extremities to any position within the range of the drooping and exaggerated lithotomy positions; also to elevate or depress the pelvis above or below the horizontal; and finally to change the relation of the trunk to any position between Trendelenburg's and the sitting postures as extremes. Hence in the opinion of the writer this is *par excellence* the best cystoscopic position.

**Anesthetics.**—Anesthetics may be general or local. The term general anesthetic is employed to mean only one administered by inhala-

<sup>1</sup> Operative Gynecology, 1901, vol. i (redrawn).



tion. As a rule this form of anesthesia is not required in cystoscopy unless it is to be followed by a major operation or unless it is desired not to disturb the patient through full knowledge of conditions diagnosed and discussed by the professional persons present. Inasmuch as cystoscopy is so frequently performed on the subjects of more or less severe and hazardous renal conditions the best anesthetic is probably nitrous oxide gas and oxygen. Chloroform has the disadvantage of sometimes causing delayed disturbance of the kidneys during the three or four days just after its administration, and ether that of immediate disturbance of these organs during the first twenty-four hours. In any event a specialist in anesthesia should always be employed when available, so that not only may the most suitable anesthetic or sequence of anesthetics be chosen but the technical administration may be the safest and wisest possible.

The term local anesthetic in cystoscopy denotes all those measures administered otherwise than by inhalation and therefore includes spinal, sacral, rectal, hypodermic, vesical, urethral and meatal anesthesia. Spinal and sacral anesthesia are analogous in that sterilized 1 in 500 cocain solution is injected respectively into the spinal or sacral canals. The total dose must never exceed one grain of cocain and as much less as possible. Strange as it may seem, a hypodermic injection of morphin fifteen minutes in advance is a serviceable physiological antidote to cocain intoxication and exhilaration. The technique of spinal anesthesia is well established while that of sacral administration, according to the method worked out by Dr. Jerome T. Lynch and described by him is as follows: The safest method to adopt especially by those who are not very familiar with this procedure, is to make an incision a little in front of the sacrococcygeal joint, and necessary extend it until an opening is found. This can be done under local anesthesia.

The point at which the needle is to be inserted is first decided upon. This can be determined by following the sacral spinous processes until they are found lacking. Slightly above this point will be found the opening canal. If, as happens in most cases, we have a bifid spine, the ridges can be easily felt, except in very fat subjects. If the canal opens near the sacrococcygeal joint this point is selected. Then, having first determined the point at which the needle is to be inserted, and this is always in the median line, it is painted with tincture of iodine. Next a little ethyl chlorid is sprayed on the skin and a hypodermic syringe containing a solution of 1 to 500 cocain, with an ordinary hypodermic needle, is next employed in order to anesthetize the skin over the area in which the needle is to be inserted, so that a small incision can be made without causing any pain. It is always better to incise the skin in order to obviate any chance of infection.

The following procedure is used in passing the needle: The needle is grasped in the right hand, and the index finger placed close to the

<sup>1</sup> Med. Rec., February 8, 1913.

point. It is then passed at an angle of about 15 degrees until the bone is reached. The needle is then passed close to the bone until it has been entirely inserted for about one inch. At this juncture it is well to pause and determine whether the needle is in the canal or not. This can be determined, as stated before, by moving the needle back and forth, up and down, and from side to side. If it is in the canal the wall will be found on all sides, and if not the needle will pass readily through the skin.

When the needle is found to be in the canal, about 4 c.c. of the same solution is deposited on each side. This is usually sufficient.

Rectal anesthesia in cystoscopy is usually secured through suppositories, chiefly of opium and belladonna, or through small enemata of the bromids and chloral. Enemata, however, are not advised as the rectum should be empty and at rest for some period prior to entrance into the bladder. On the same ground but in less degree suppositories are faulty unless opportunity for melting has been given.

Vesical, urethral and meatal anesthesia in cystoscopy is maintained by the writer with the following technic: After suitable cleansing of the bladder and urethra with a catheter, the bladder is moderately distended with alypin solution (2 to 4 per cent. in water). About one inch back from the meatus a rubber elastic band is slipped tightly over the penis for a watertight hold on the catheter. While the catheter is slowly withdrawn the alypin solution is flooded into the urethra until moderate distention is secured. After this the catheter is withdrawn while the band closes the urethra and imprisons the anesthetic behind it. The meatus is now anesthetized by dropping a few minims of 10 per cent. cocain solution in water into it while it is held open. This procedure will ordinarily anesthetize the whole urethra and the bladder for about five minutes with very little change in the appearance of the mucosa.

Eucain in similar or slightly weaker solutions may be employed in the same way but is seemingly more toxic than alypin although less so than cocain. Cocain in such a quantity is positively dangerous.

Alypin in 2 or 4 per cent. suspension in Irish moss or tragacanth may be deposited in the urethra from end to end with the ointment applicator of the writer. This has the advantage of lubricating the urethra for the passage of the cystoscope but the disadvantage of washing before it into the bladder the jelly which lies upon its floor until dissolved, which is often inconvenient, especially as it may obscure small lesions considerably.

Depositor sounds or catheters may be used for laying pellets of alypin or eucain within the deep urethra, which is best accomplished when the shaft of the instrument is at 90 degrees to the vertical axis of the body. The Bradford Lewis urethral applicator is a serviceable form. It is shaped like the standard silver catheter with the end open and with a lateral outlet in the same plane as the tip but directed away from it. Through this instrument the bladder is filled. It is then withdrawn until the outflow just stops, showing that its beak is distal to the



sphincter. At this point the pellets are applied by being pushed out the vesical opening of the instrument by a more or less flat fac obturator. The number of pellets, of course, determines the dose. The meatus may be anesthetized as just described with a few minims cocain water or with more alypin pellets. The fault of this method is that the urethra between the meatus is usually not at all affected by the anesthetic, which should not be the case if it is worth while using any anesthesia.

Female cases demand a slightly different management with regard to the urethra alone which corresponds with the prostatic urethra in the male, but is flaccid, wide and dilatable. Usually a few pellets alypin may be deposited into the meatus which is commonly the point of most sensitiveness.

Choice of local anesthetic is reached solely through consideration of the general nature of the case. As a rule, examinations of simple character require only gentleness, deliberation and dexterity in order to reach a final opinion; in this manner no anesthetic is usually employed in them. On the other hand, nervous patients may require the administration of sedatives locally as well as generally. The bladder itself may demand local anesthetics from the nature of its suspected lesion such as inflammation, foreign body and tumor. Incontinence of vesic or spinal origin is another important requirement, while pus and blood from the bladder wall make up the list. If in these various conditions the bladder is not quiet and insensitive the examination will be defeated either through agitation of the patient or spasmodic action of the bladder wall. The former will prevent the operator from securing cooperation of the patient while the latter will cause the recurrence of hemorrhage, purulent discharge, incontinence and the like. As a rule the gentle instillation of a solution such as 2 or 4 per cent. alypin or warm water into the bladder, step by step, up to full distention is sufficient. When, however, conditions are such that the bladder does not retain even this, then spinal or sacral anesthesia is necessary. On all points in the decision are the importance and difficulty of the case. If the lesion is one of gravity with the diagnosis resting on a close decision then by no means should the best obtainable form of anesthesia be omitted. For this reason spinal and sacral anesthesia fulfill the wide range of indications. One can hardly go wrong in giving them their place in such circumstances.

**Prerequisites.**—Prerequisites of successful cystoscopy may be summed up as follows:

1. Mentally assured, nervously quiet patient, with a urethra known patency, preferably 24 F. to 26 F., otherwise adapted to any of the special subcaliber cystoscopes, 18 F., 15 F., or 13 F.
2. Asepsis and antiseptics of instruments, accessories and dressing patient, operator and assistants.
3. Medium of vesical distention, transparent, translucent, clear and unirritating.

4. Good steady illumination, not so intense as to tire the eye of the operator, or so potent as to burn out the lamp.

5. Bladder dilatable to 100 to 150 cm. without pain, spasm or incontinence.

6. Bladder as free as reasonable from points discharging blood or pus. Frequently such a bladder is obtainable only after the due administration of local or general anesthetics and gentle but free irrigation with styptics and pus-solvents.

**Essential Preliminaries.**—Essential preliminaries to cystoscopy may be enumerated in the following manner, including first those independent of the patient himself and second those dependent on the patient himself.

In the former class belongs the electrical equipment in particular, which should always be investigated at short regular intervals for the major parts of the apparatus and before each cystoscopy for the minor parts of it.

Asepsis, antisepsis, patience and perseverance are the watchword of success.

1. Batteries should be examined at least once a week for dead dry cells or polarized elements of the moist cells. The ordinary pocket voltmeter is serviceable and sufficient as a rule.

2. Wires and cables must be examined for loose or dirty connection and for broken or moist insulation.

3. Switches should make firm, clean contact between brightened metal contact parts.

4. Cystoscopes must be inspected; their essential elements counted, fitted and arranged; their lens systems tested, preferably in water on a familiar object; their illumination regulated to the proper degree of intensity to give a good view of the object under water with continuous light and next with the light turned on and off several times; their irrigation circuits must be free of obstruction and of leaking faucets and connections; their ureteral catheters must be tested for patency, assembled on the catheterizing telescope with their distal tips just back of the deflector and their proximal ends plugged with pins against leakage.

The essential elements of the cystoscope include the sheath with its electrical outfit complete, the obturator and the telescopes for inspection, ureteral catheterization and retrograde examination, if the instrument is designed to do these threefold functions. Otherwise separate cystoscopes must be at hand accordingly.

Spots on the lens system are due to foreign matter on the eye-piece or objective lens, which should be accordingly cleansed. If general blurring is present water is usually in the telescope among the various lenses.

Irrigation may fail through dried pus or blood in the stop-cocks, which may be removed with wires fitting the lumen properly.

Illumination may be uncertain or fail through a number of causes which must be determined by regular search from the source of the



electricity to the lamp, as set forth in the preceding paragraphs. Namely, the operator must prove no defect to exist in the battery, the wires, the cables and the switches, especially the switch in the circuit at the cystoscope. After this is done the trouble may be traced by the following steps:

1. Change of cystoscope may at once fix the difficulty in the instrument discarded.
2. Change of cable may similarly locate the trouble in the removed not apparent to the previous examination.
3. Change of lamp may serve in exactly the same manner. When the second lamp is inserted the contact within the socket had been scraped bright with a knife and the little contact wire at the base of the lamp lifted slightly outward with the knife blade in order to insure good contact.
4. The lamp removed should be tested by freeing its contact as just described, setting this carefully against one pole of the controller and with any convenient instrument completing the circuit by connecting the other pole with the outside of the lamp. If illumination now fails the trouble is in this lamp.
5. The binding posts of the cystoscope receiving either the American or spring (European) coupler may be short circuited by moisture admitted during irrigation. In the modern instrument this is impossible but should it occur the coupler should be disconnected, thoroughly dried and replaced. In the older American couplers a small piece of vaseline between the posts and the socket will prevent this accident.

The essential preliminaries to each cystoscopy dependent on the patient himself should receive attention when the operator is about to begin that all those independent of the patient are in order as set forth in the foregoing paragraphs. Of chief importance are the following:

1. Assurance of the patient which rests primarily with the physician before the actual visit to the cystoscopist, and secondarily with the latter in virtue of a quiet, dignified, orderly manner.
2. Comfort of the patient which is reached primarily by the physician in the adjustment of pillows and draperies, and secondarily by the operator in the arrangement of the table so that the patient's muscular system will be relaxed and nervous system undisturbed.
3. Preparation of the bladder is one of the most important factors of success and may be considered under the following headings:

**Preparation of the Bladder in Uncomplicated Cases.**—Some authorities teach that when the urine is clear and the bladder not greatly distended the urine may be retained as the distending medium. For the experienced expert this may be an allowable rule; but on the whole it is best to become accustomed only or chiefly to the appearance of the mucous membrane through one standard medium of distention, a clear normal salt solution or 2 per cent. boric acid water, both standard of course. The wisdom of this rule is axiomatic just as is the common sense of the rule that one should become so far as possible skilled in the use of one kind of cystoscope before taking up others. The

of the urine varies so that the deeper shades are capable of changing the color of the mucosa greatly, hence the appropriateness of a colorless medium whenever possible.

There is one exception to this objection to the urine as a medium of distention—namely, tuberculosis of the bladder, which is usually so intolerant to any other medium than the urine that the latter must be employed, provided, of course, there is no pus or blood present.

Distention of the bladder must respect the comfort of the patient, rest to the bladder and the unfolding of the mucous membrane as a whole, so far as practical. Hence the amount of fluid or air injected must not cause pain by pressure or irritation either by the chemical character of the fluid, or by mechanical excitation of the evacuation reflex. In the average male bladder from 100 to 200 c.c. of fluid and in the female about 100 c.c. additional will secure these desiderata. Increase in the distention is always a reserve in the hands of the cystoscopist for diagnosing under the eye the meaning and limits of abscissions, diverticula, deformities and fixations due to extravesical and intravesical tumors.

The amount of fluid injected should always be measured in both complicated and uncomplicated cystoscopy as a guide to diagnosis; for example, in some neuroses of the bladder without obvious disease of its walls relatively little capacity exists, which may not be apparent unless the quantity of fluid injected is measured at the time of the cystoscopy and subsequently tested for comparison and variation.

The limit of distention is the greatest among which the patient will tolerate without pain, spasm or nervous irritation, and which will produce a size of bladder within the limits of the mechanical and optical reach of the cystoscope. In other words, the bladder may best be studied in a condition of great enlargement provided the cystoscope may be carried to the proper focal distance in all directions. If this degree of distention is exceeded, manifestly the work of cystoscopy will fail of definite results.

Choice of medium of distention is between air and fluid. Air is available and advantageous when the walls of the bladder are discharging blood or pus so rapidly that a fluid medium cannot be kept translucent and transparent for the examination. In these circumstances air affords a good opportunity to view the bladder as a whole and perhaps locate the chief points of discharge. But the accumulation of the blood or pus on the mucosa soon obscures a study of it so that the operator is soon no better off than he was with the increasing turbidity of the fluid. The difficulty may ordinarily be circumvented. Having located the chief bleeding point or points, the cystoscopist evacuates the air and replaces it with sterilized normal salt solution, using the etherizing cystoscope mounted with a 5 F. and a 7 F. ureteral catheter; the larger as inlet and so adjusted as to clear the field of blood or pus but not as to obscure direct vision, and the smaller as outlet permit him to examine each lesion in the presence of flowing solution, with the one setback of a swirl, but with the great gain of a clear field.

**Materials from the Family** include sterilized dry goods in full assortment, towels, sheets, gauze, cotton, rubber sheeting and table oilcloth, various utensils such as slop jar, hand basin, pitchers or bottles for hot and cold sterilized water, ironing board or table leaves for passing between the mattresses of the bed when a table cannot be provided, as much preferred. The examination may be done with equal accuracy either on the bed or on the table, but the bed is so low as to constitute a real obstacle for facile work.

**Details in Charge of the Nurse** vary in home work from those in office or hospital work only in the oversight she must have as to the duties of the family, otherwise they are identical.

**Instruments and Supplies of the Operator and Assistant** comprise either a universal or composite cystoscope, or a series of cystoscopes, especially a small examination, a direct catheterism and an indirect catheterism instrument, including a retrograde vision telescope. For female cases a set of Kelly's direct vision cystoscopes may be added in suitable cases. The full irrigation equipment of syringes and rubber tubing, and the electrical layout of cables, batteries, transformer or controller with resistance lamps, together with sounds for urethral exploration are included. Urethral and ureteral catheters, test-tubes, glasses, bottles and graduates for specimens are important, likewise drugs such as cocain, alypin, nitrate of silver and the lubricants.

**Arrangement of the Room** is exactly the same as in the office or hospital so far as the circumstances of the family and the general surroundings will permit.

**Floor Plan of the Room.**—For the instruction of nurses and assistants in a brief and definite manner as to furniture, dressings, utensils, instruments and similar supplies necessary for a cystoscopy, it will be found that a floor plan of the room, as a diagram and inventory, which contains most of the essentials will be of great convenience.



FIG. 195.—The cystoscopic field in the corrected image instrument. (Marion. Heits-Boyer, Germain.)

### TECHNIC OF CYSTOSCOPY.

Details of technic of cystoscopy respect the following points in addition to such as have been elucidated by the foregoing sections—



position of the patient; the general and local anesthesia of the patient; preparation of the bladder; the standard management of the easy cases, and of difficult cases; and the recognition of the causes of complications and failures in the examination.

**Postures of the Patient.**—Postures of the patients vary within the experience of most cystoscopists. The writer has found that the average patient is most comfortable for himself and most manageable for the operator when placed in what has been denominated a few pages ago as the position of moderate universal flexion. This term means dorsal decubitus posture with the trunk slightly flexed upon itself



FIG. 196.—Universal flexion posture for cystoscopy.

to bring the head above the level of the elevated pelvis, and with the lower extremities either in the lithotomy position or in the drooping position on each side of the operating table. In addition to this attitude of moderate universal flexion many cystoscopists elect the lithotomy position, exaggerated lithotomy positions, with or without elevation of the pelvis, both of which are too well known to need further notation. The genufacial, otherwise called the genupectoral or knee-chest position is limited entirely to female cases, and among these only to those cases suitable for the cystoscopic tubes. The difficulties and disadvantages of this attitude for both patient and operator are obvious and have already been alluded to.

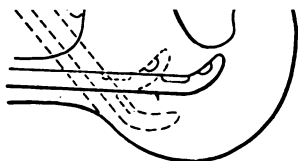


FIG. 201

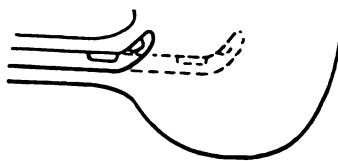


FIG. 202

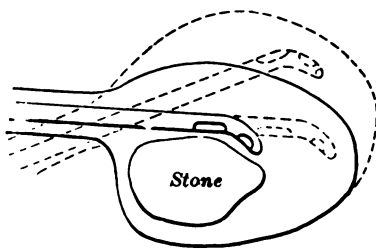


FIG. 203

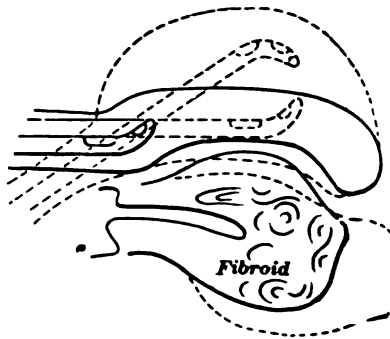
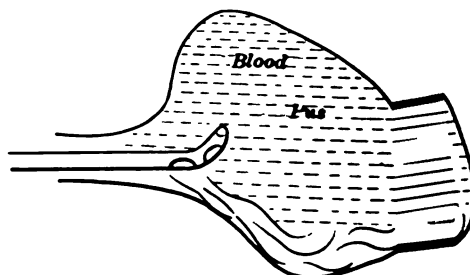
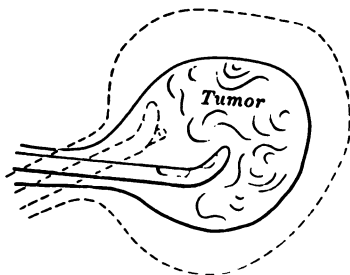


FIG. 204



FIGS. 199-204.—Common obstructions to cystoscopy and their correction.<sup>1</sup>

FIG. 199.—Shows the field of the cystoscope obstructed by the wall of the bladder, either by insufficient dilatation or by a diverticulum. Relief of the condition is shown (1) by the cystoscopes in dotted lines, one after withdrawing the instrument until the pouch is cleared and the other after elevating the eye-piece in order to focus the lens, and (2) by increasing the dilatation indicated by the dotted bladder wall.

FIG. 202.—Shows the field of the cystoscope obstructed by the wall of the urethra by insufficient penetration. Relief of the condition is shown by the cystoscope in dotted lines suggesting further penetration.

FIG. 201.—Shows the field of the cystoscope obstructed by contact with a stone usually by insufficient preparation of the bladder for examination. Relief of the condition is shown: (1) by the cystoscopes in dotted lines, one after increased advance of the instrument and the other after depressing the eye-piece to focus the lens and the third after changing to a close vision instrument, and (2) by increased dilatation indicated by the dotted bladder wall.

FIG. 202.—Shows the cystoscope obstructed by a tumor of the uterus so that manipulation is impossible. Relief of the condition is: (1) by Trendelenburg's posture which carries the uterus away from the bladder as shown in the dotted lines; (2) by increased dilatation as indicated by the dotted bladder wall; (3) by advancing the cystoscope as shown by the dotted instrument and (4) by changing to a close vision instrument also outlined in dots.

FIG. 203.—Contains a tumor of the bladder covering the field of the cystoscope. The condition is relieved (1) by increased dilatation as shown by the dotted bladder wall, when possible, and (2) by changing to the direct vision cystoscope as shown in dotted lines.

FIG. 204.—Contains a bladder filled with pus and blood which cannot be thoroughly removed. View is obtained by using irrigation as shown by the swirl of fluid, along the floor of the bladder.

<sup>1</sup> Modified and amplified from Pilcher; Practical Cystoscopy, 1911.

The cystoscope may fail through defects in the lamp or lenses. One should always test the lamp outside the bladder in the same medium as it will be used in distention after bringing the light up to white brilliance. A supply of reserve lamps should always be part of the equipment. Sometimes the lamp may have become smeared with blood, pus or lubricant and thus its illumination depreciated. The lenses may be soiled with the same substances, partially or totally obscuring their field. A black spot in the field is recognized as being in the lens system by moving the instrument formly with the instrument in all directions. Hence the lenses should always be inspected and cleansed before the telescope is introduced. The lens system as a whole may be out of commission through entrance of water into the telescope at some point.

The cystoscopist may fail through unfamiliarity with the science of cystoscopy, lack of knowledge of the focal distance of his instrument or the correct direction of his objective. If the instrument is a new one and the picture dim it may be improved by making the objective either approach or recede from the surface of the bladder. A blood-red picture usually means that the objective is too close to the surface and should be elevated from it by depressing the eye-piece. Darkness in the instrument or absence of picture when the lamp and electric circuit are known to be perfect means that the objective is covered either in the neck of the bladder or by the wall during insufficient dilatation, or by the presence of vesical contents such as tumors, calculi and the deformation of extraneous organs or conditions.

The bladder contents and annexa cause loss of picture in the manner just described.

The diagrams Figs. 199-204 are designed to indicate these difficulties generally. The dotted outlines of the instruments show in general terms manipulations which may correct the troubles in part or in whole. It should be remembered that when such difficulties arise the ingenuity, patience and perseverance of the operator are called strongly into play.

**ésumé of Cystoscopic Difficulties.**—Failure in cystoscopy proceeds from the following four causes: light, lens, bladder and contents, and it is well to mention the chief elements under each.

The light may have loose or broken connections, burned-out lamp or defective circuit.

The lens may be buried in a flaccid bladder, a diverticulum, or the urethra. It may be covered with blood, pus or lubricant, especially if vaseline or a grease has been used. The wrong focal distance may be employed.

The bladder may be collapsed from escape of irrigation fluid, sacculated or diverticulated. Acute inflammation may mask landmarks and details.

The contents may be blood, pus, chyle and the like, or a stone or other mass may impede adjustment of the cystoscope.

These difficulties are diagrammed in Figs. 199-204 in the black lines of the drawing and the correction of each difficulty is shown by the dotted lines of the drawing and by the explanation in the legends. In the main and common conditions are covered.



## CHAPTER XIV.

### THE BLADDER.

#### I. NORMAL BLADDER.

##### INSPECTION, LOCALIZATION AND ORIENTATION OF THE BLADDER.

**Anatomy.**—The bladder will be remembered as subdivided into the apex or summit, the body, the base, fundus or floor and the neck or outlet. The apex corresponds to the attachment of the urachus and is normally the highest point of the viscus in both the empty and full states and is covered with peritoneum only in its posterolateral aspects. Anteriorly it forms the posterior boundary of the upper part of the prevesical space. The body of the bladder completes this space down to the prostate gland and triangular ligament in front, lying therefore behind the symphysis pubis. Posterolaterally the body of the bladder is also covered with peritoneum and lies against the uterus in the female, the rectum in the male and coils of small intestine in both sexes. The vasa deferentia cross it in an arched anterointernal direction along the sides. The base, fundus or floor of the bladder is again uncovered with peritoneum and is in relation in the male with the prostate, seminal vesicles and ampullæ of the vasa deferentia. In the female it is in relation with the cervix uteri and the upper portion of the vagina. In both sexes it is crossed and pierced by the ureters from behind forward and from without inward. The neck of the bladder is not funnel-shaped in health but flat where the sphincter closes it so that the surface is quite flat excepting the dimple of the urethral entrance.

**Introduction of the Cystoscope.**—The preliminaries are the uterine asepsis of field, instruments, accessories and operators, lubrication and patency of the canal. The technic varies slightly between the straight tubes and the beaked instruments. It also is modified by the various positions of the patient, namely, those of moderate universal flexion, lithotomy, exaggerated lithotomy, sitting, genufacial and moderate general extension. Sex and age have an influence on technique, children usually requiring a general anesthetic and females ordinarily affording far more ready insertion of the instrument.

The instrument is best passed after the patient is comfortably in the selected posture, fully draped and ready for the examination.

Moderate universal flexion and all other postures except the genufacial and the moderate general extension require the operator to stand opposite the perineum in the midplane of the body in both males and females.

Beaked instruments are engaged by their tip in the meatus while the shaft is held in the midplane of the body and more or less parallel with the abdomen. In males the penis is stretched and held vertical while the beak is gently advanced to the bulb of the urethra. Here it is supported against the pubic arch, either by slight tension upward or by gentle pressure with the free hand on the perineum, until the beak is felt to enter the membranous urethra, from which it will gently slide into the bladder as the eye-piece is depressed evenly and gently until about parallel with the operating table. In healthy urethrae the foregoing steps are easy. With the deformity of prostatic or other disease, however, considerable patience is often required with variations in the details. Subcaliber instruments are not uncommonly necessary.



FIG. 205.—Introduction of the cystoscope: distention of the bladder.

In females and in males with deep bulbous urethrae, the finger must support the urethra respectively in the vagina and rectum, as described in the technic of straight instruments.

When straight instruments are inserted as follows, the guiding finger being inserted in the vagina in females and in the rectum in males. The penis is held straight and vertical and the tip passed from meatus to bulb as before, with the shaft in the midplane of the body and vertical. The guiding finger is now inserted and its tip bent upward around the sphincter until it touches the beak. With the instrument steadied at this point, the finger is straightened and pushed forward until the apex of the prostate is reached and there brought to rest. The eye-piece of the instrument is now depressed while the beak is made to travel along the finger, which raises it as it reaches the apex of the prostate so that it enters the membranous and then the prostatic urethra. The manipulation in women is obvious.

In difficult cases it is well to pass a soft instrument first, and then to explore the relation of this instrument to the prostate through the rectum before attempting to use the metal instrument.

Genufacial posture is confined to women and the Kelly cystourethroscopic tubes. The introduction is much the same as in the other postures in women, remembering only that in this attitude the urethra is practically horizontal, and that therefore the direction of the instrument is changed almost to an absolute reverse.

**Moderate General Extension** requires the same manipulation of the cystoscope as does the dorsal decubitus disposition in passing the ordinary sound. The operator stands at the side of the patient and holds the instrument either in the midplane of the body, and parallel with the abdomen, or over the groin, and parallel with it. After the beak has been engaged into the urethra it is advanced to the bulb in the midplane of the body from its first position, over the abdomen, or brought to the midplane by rotation from its first relation to the groin. After the bulb is reached, the instrument is advanced into the bladder by elevation against the symphysis pubis as it proceeds or by perineal or rectal pressure.

The sphincter of the bladder may be spastic. In this event gentle pressure and patience usually overcome the difficulty. Local anesthetics are of great importance in preventing it.

**Plans of Examination.**—Regular plans of examination of the bladder vary from one operator to another. The following in the opinion of the author is the best method. Inasmuch as the floor of the bladder including the ureters and the trigonum is in a certain sense the most important part, they should receive first attention before the medium changes or perhaps the eye of the operator tires. The steps of the procedure are as follows:

**Plan of Orientation of the Bladder with the Lateral Vision Cystoscope.**—

1. The air bubble at the apex of the bladder is at once located and regarded as in most cases marking the highest point and the middle line.
2. The instrument is then rotated to the patient's right through 180 degrees to the base of the bladder in the middle line. It is then slowly withdrawn until the posterior of the red trigonum is recognized, distinctly set off from the paler portion of the base behind it.
3. The interureteric bar (plica interureterica) is next distinguished.
4. The instrument is now rotated to the patient's right along the plica, if present, or if absent along the red border of the trigonum until the right ureteric mouth is reached. The arc of rotation varies from 30 to 60 degrees from the middle point according to the proximity of the ureters to each other.
5. The left ureteric mouth is located in the same way by rotation in the opposite direction, 30 to 60 degrees from the middle line or 60 to 120 degrees from the right ureter.
6. After both ureteric mouths have been studied the instrument is withdrawn about 3 cm., or the diameter of a focal field, and swept

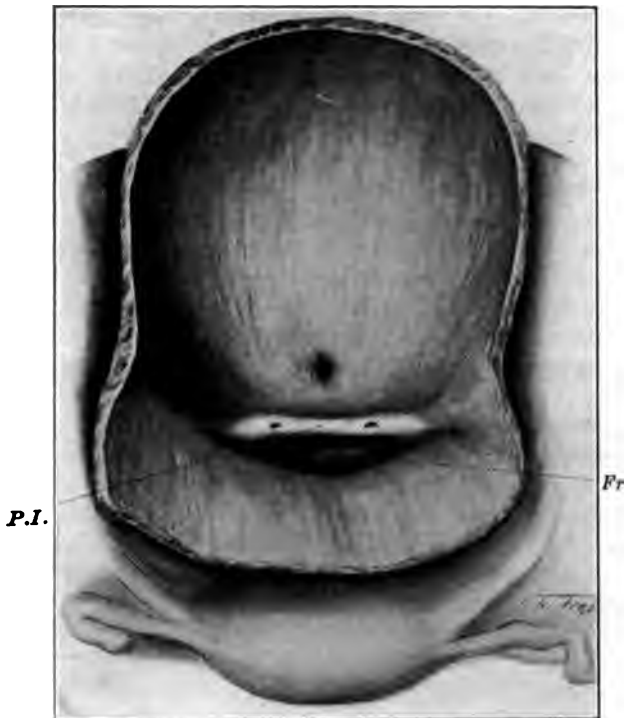


Fig. 206.—Apex in urachal and retro-  
vic zones<sup>1</sup> containing air bubble at  
ally highest and middle point of the  
ura.



FIG. 207.—Retropubic zone<sup>1</sup> with il-  
luminated middle portion over the sym-  
physis, less illuminated section above  
this until the lamp and lens are carried  
into it and the neck encroaching on the  
field below.

Figs. 206 and 207.—Normal bladder. (Marion, Heitz-Boyer, Germain.<sup>2</sup>)



208.—Bladder opened, showing relations of the ureteral openings, urethral  
lig and the interureteric ligament. *P.I.*, interureteric ligament; *Fr.*, fossa retro-  
ica. (Leipmann.<sup>3</sup>)

<sup>1</sup> V. C. Pedersen: New York Med. Jour., August 23, 1913.

<sup>2</sup> Loc. cit.

<sup>3</sup> Leipmann's Atlas: Gynaekologischer Operationskursus. 1911.

through an arc of 180 degrees from left to right, thus covering a field zone of the trigonum immediately in front of the ureters.

7. From this position at the right it is again withdrawn 3 cm. until the neck of the bladder begins to interfere with the field and then swept 180 degrees to the left. Usually one field-zone will cover the trigonum, but exceptionally this plan of field by field procedure is necessary.

These several manipulations serve to study the ureters and trigonum and the lower posterior quadrant of the bladder in a very complete manner, if the bladder is regarded as subdivided into anterior and posterior halves by the transverse plane passing through the neck and urethral outlet as the patient stands in the anatomical position.

8. The instrument is now advanced to the interureteric bar again in the middle line as the chief landmark, and next 3 cm., the diameter of a focal field, beyond it. From this point it is rotated 90 degrees to the patient's right and next 180 degrees to the left, thus covering a field zone just behind the ureters.

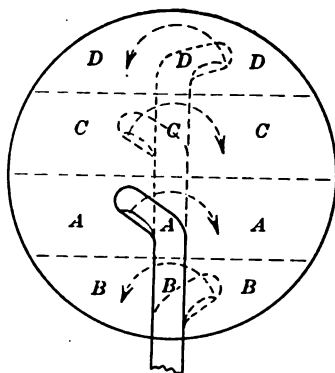
9. At this moment it is advanced another 3 cm. and rotated 180 degrees toward the patient's right. If more of the floor remains to be inspected the same manner of procedure is followed, by advancing the instrument into the bladder about 3 cm. and sweeping it slowly through 180 degrees from side to side, step by step.

10. When the upper posterior quadrant has been in this manner completely studied, the instrument is rotated upward through 180 degrees from the patient's right to left, thus covering the most posterior field zone of the upper posterior quadrant. At the left point it is withdrawn the diameter of a cystoscopic field and rotated to the right through 180 degrees, where it is again withdrawn 3 cm., viz., the diameter of a field, and rotated to the left over 180 degrees. These three field zones commonly serve to cover completely every square centimeter of the upper anterior quadrant, otherwise called the apical, or urachal quadrant.

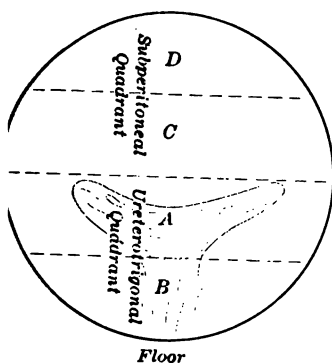
11. By exactly the same procedure the lower anterior or retropubic quadrant is studied, one field zone at a time, each having a width of one cystoscopic field and extending from side to side through an arc of 180 degrees. As a rule, from two to four such zones complete the inspection of this and all other quadrants.

12. When the neck has been reached as much as possible thereof is inspected in the same manner in a single field zone in both the ureterotrigonal and the retropubic quadrants.

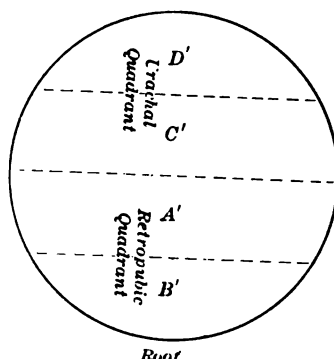
It will be noted that this method divides the bladder into anatomical divisions, viz., the fundus, floor or base, which is covered by the ureterotrigonal and subperitoneal quadrants and examined in accordance with paragraphs one to nine as just stated; and the apex and sides which are included in the apical or urachal and retropubic quadrants as laid down in paragraphs ten to twelve inclusive, which also embrace the neck of the bladder as perhaps properly an integral zone.



209.—Shows four positions of the cystoscope, arcs of rotation and zones traversed.



Floor



Roof

FIG. 210.—Presents the floor of the bladder with its ureterotrigoal and subperitoneal quadrants and the four zones of inspection comprised in Fig. 209.

FIG. 211.—Contains the roof of the bladder with its urachal and retropubic quadrant and the four zones of inspection also indicated in Fig. 209.

FIG. 209.—Four positions of the cystoscope are shown in the order in which they are taken, A, B, C, D.

The first position, A, shows the beak horizontally placed toward the patient's right in the ureterotrigoal quadrant over the right ureter. From this point it is slowly rotated downward through 180 degrees in the direction of the arrow, A, until it occupies the opposite position horizontally placed over the left ureter. This sweep makes it traverse the A, in Fig. 210, embracing both ureters and their folds, the interureteric fold and fully the trigonum.

The second position, B, is made by withdrawing the instrument over the diameter of the field in the horizontal plane of the beak at the last step of the first position. From this point it is rotated downward and to the right in the direction of the arrow, B, through 180 degrees, until it occupies the opposite position horizontally placed over the right ureter. This sweep traverses the zone B, in Fig. 210, and inspects the anterior portion of the trigonum and the neck in part.

The third position, C, is obtained by advancing the instrument in the same plane as it occupied at the last step of position B, until it is beyond the zone A, and in the subperitoneal quadrant represented by C and D. It is now rotated through 180 degrees downward in the direction of the arrow C and thus inspects the lower half of the said quadrant, represented by C, in Fig. 210.

The fourth position, D, is reached by advancing the instrument in the same plane as it occupied at the last point of position C and one field back thereof. It is now rotated downward through an arc of 180 degrees in the direction of the arrow D, thus completing inspection of the upper limits of the subperitoneal quadrant, diagramed in Fig. 210. D. These four positions, or if necessary an increased number taken in exactly the same order, thoroughly examine the floor of the bladder. For examining the roof, the same method is followed but in the reverse order. This means that the cystoscope from the point of position D, is rotated through an arc of 180 degrees upward thus traversing the best part, D', of the urachal quadrant D'C' in Fig. 211. The remaining zones, C', and in the retropubic quadrant, A'B', are inspected in the order given by the same steps.



**Plan of Orientation of the Bladder with the Axial Vision Cystoscope.**

One cannot include the Kelly cystourethroscopic tubes for the reason that the management of the bladder therewith is so different from that with the telescopic axial vision instruments. For this reason orientation of the bladder with the Kelly tubes is detailed separately as follows:

1. The cystoscope having been introduced with the preliminaries and cautions previously described and with the telescope inserted and locked, is held in the midline of the bladder with the lamp up and adjusted to give a clear field, which usually lies in the posterior superior or extraperitoneal segment of the bladder.

2. The cystoscope is withdrawn in the middle line, maintaining a clear field until the red border of the trigonum and the plica interureterica is in view.

3. Maintaining the objective in the same plane the instrument is made to travel along the landmarks in view, as above, toward the right until the right ureter and the ureteric fold have been studied.

4. Still, in the same plane, the instrument is swung in the opposite direction until the left ureter and its fold have been examined, thus completing the posterior zone of the ureterotrigonal segment.

5. With the left ureteric fold in view the instrument is withdrawn until it disappears and then swung in this plane over toward the right, thus completing the next field-zone of the trigonum and in this manner embracing all that can be examined with the axial vision cystoscope in this point.

6. The cystoscope is now returned in the midplane of the bladder until the plica interureterica disappears from the field, when the process of swinging the instrument to the right and then to the left in the same plane as far as possible is repeated and the lower field-zone of the posterosuperior segment is completed.

7. From the extreme left point of this left field-zone the instrument is advanced until some detail at one margin disappears at the opposite margin of the field, when the instrument is made to traverse from left to right as far as possible. This completes the second field-zone of this segment and others if present are covered in the same manner.

8. At this point on the extreme right the objective is elevated by depressing the eye-piece, and by the same lateral sweep from right to left is made to cover the posterior field-zone of the subperitoneal segment.

9. With further depression of the eye-piece and withdrawal of the instrument until a landmark at once disappears at the opposite margin of the field, the instrument is traversed over the bladder in the opposite direction from left to right, thus, as a rule, completing this segment of the bladder; otherwise additional duplicate steps will do so.

10. Again, with depression and withdrawal, as before, the posterior field-zone of the retropubic segment of the bladder is reached, and with the lateral sweep made to cover it.

As a rule, no more of the bladder than this can be examined with the

al vision instrument and resort must therefore be had to the retro-  
on telescope of the lateral field instrument or to the cystourethro-  
pe of Buerger.

**Convex Sheath Close-vision Cystoscope and with the Plan of Orientation  
of the Bladder with the Cystourethroscope.**—Of the various instruments  
in his class available, the cystourethroscope perfected by Buerger and  
Acmi convex sheath close-vision cystoscope seem to be the most  
desirable.

The Acmi close-vision cystoscope permits more rotation, being liter-  
ally a lateral vision instrument with a close field, whereas the cysto-  
throscope requires the sweeping technic of the axial vision instru-  
ment, but both share in this detail somewhat.

. The instruments are inserted, brought to the middle line, over  
the margin of the trigonum, along which their fields are made to travel  
until the ureters and their folds have been studied.

. With the same detail of laying out field-zones, previously described,  
the trigonum is studied with the neck of the bladder at the trigonum,  
through 180 degrees.

. The instruments are then rotated upward and withdrawn until  
the neck of the bladder begins to occupy the field, which is recognized  
by its brilliant illumination compared with the less distinct bladder  
body beyond. The neck at this point is then reviewed.

. The instruments are then advanced with great depression of the  
speculum, so as to bring the portion of the urachal segment of the  
bladder into view.

There is no reasonable excuse, therefore, for failure to cover every  
portion of the bladder with these plans of procedure, providing for the  
utilization of the laterovision cystoscope with the retrograde, recto-  
grade and anterograde telescopes, of the axial vision cystoscope, and  
of the close vision convex sheath cystoscope and of the cysto-  
throscope.

It will be at once realized that where the imaginary transverse  
vertical plane of the bladder meets the walls a right and left meridian  
are outlined, and that where the imaginary horizontal plane crosses  
the bladder a line which should be called the equator of the bladder is  
defined. And that neck and apex are the lower and upper poles.

These designations, as previously stated, are referred to the ana-  
tomical position which is erect and at 90 degrees to the recumbent or  
obscopic position. Therefore in the latter the transverse vertical  
plane and the meridians are horizontal while the horizontal plane and  
equator are vertically placed. No confusion, however, need arise  
if little care is exercised until one is familiar with this geography of  
the viscus as it might be called.

This method of examining the bladder is not so laborious as the  
former description might suggest. It omits nothing and also permits  
of a reasonably accurate charting of the point of the lesion. If we consider  
that three field zones commonly cover each quadrant it is possible, for  
example, to describe a lesion as situated "in the lower posterior quad-

rant, middle field zone, 60 degrees to the left and extending to 90 degrees, and reaching a diameter of two-thirds of a focal field."

**Examination of the Vesical Mucosa as a Whole in Cystoscopy** respects the following features: color, vessels, gloss, continuity, edema, elasticity, new growth, ulcers, foreign bodies and contents, such as urine, blood, mucus and pus.

1. Color of the mucosa varies with health, illumination and disease. In health it should be whitish with an admixture of yellow and red of moderate degree throughout the whole of the bladder except the trigonum, where a dull positive redness exists through great vascularity.

Illumination when white and intense and when close to the surface decreases the yellow-red tone but when itself less white and strong or more remote from the field increases it. With light of known quality and intensity it is a good diagnostic point to approach and recede from the mucosa to notice whether the color so changes. If the redness is much the same inflammation is present.

In disease the color becomes paler in anemia but deeper in all conditions of congestion and inflammation.

2. Bloodvessels in the bladder are in normal cases outlined well against their annexa in the mucous membrane much like the rivers in school geographies. The arteries are smaller and redder than the veins and may occasionally be seen to pulsate. In the trigonum the vessels may no longer be distinguished from each other owing to the close mass of the capillaries in this region and the resultant somewhat uniform dull redness. These capillaries may, however, be recognized as interlacing in health. With circulatory obstruction varices of the bladder may be present and interesting; in anemia the vessels may be difficult to recognize, and in atrophic bladders they may be practically absent in the cystoscopic field.

3. Gloss of the epithelium of the bladder is in health unmistakable and resembles that seen in other mucous membranes although not of high degree. It is best perceived by changing from the normal to the oblique field with rotation of the instrument. Congestion, inflammation and circulatory obstruction result in swelling, edema and loss of gloss, disseminated universally or in patches here and there.

4. Continuity of mucosa in the bladder implies absence of any breaks in the surface either by ulcers, erosions or zones of inflammation. It is, therefore, in milder degrees analogous to gloss. In higher degrees, however, it implies actual loss of substance, superficially or deep.

5. Edema of the bladder lining is that actual swelling of the mucosa which invariably implies inflammation or great vascular obstruction. It may occur over the bladder wherever in view or only in scattered areas, few or many in number, or as a special form called bullous edema.

6. Elasticity of the bladder walls is synonymous with its muscular action and distensibility. Muscular contraction manifests itself by the appearance and disappearance under the eye of fine fibrillar trabeculations, in the midst of previously smooth mucous membrane.

With the fixed trabeculations of the hypertrophied bladders in the chronic cystitis of prostatism and urethral stricture, muscular action accentuates the bands and deepens the pockets, which are harder than before to illuminate. Distensibility of the bladder has no effect on the latter but usually corrects the former much as it does those folds which appear before the bladder is completely filled.

7. New growths in the bladder wall receive attention as to the quadrant and zone of their location, their number, size and form, their sessile or pedunculated attachment, their vascularity and hemorrhagic tendency, their unbroken or broken and sloughing surface, and their annexa.

8. Ulcers and excavation of the vesical mucosa are similarly described as to location, number, size, outline, floor, edges, vascularity and annexa, especially in tuberculous ulcers which frequently have numerous tubercles in their neighborhood.

9. Foreign bodies, including calculi, gravel, masses of mucus and pus and exfoliated epithelium in the bladder, are studied in the same way as to location, number, size, outline, fixity and effect on the surrounding mucosa. Fixity had best be tested with a ureteral catheter or other instrument.

10. Contents of the bladder in cystoscopy of importance are blood, pus and mucus and should be noted as to source, rapidity of appearance, amount, fluidity or clotting and thickening, and adhesiveness. The chief sources are the ureters, the mucous membrane and the neck of the bladder.

**Anatomical Subdivisions of the Bladder in Cystoscopy.**—Having completed the general features to be borne in mind, we next consider the chief anatomic subdivisions of the bladder requiring study, namely: the neck, the trigone, the ureteral openings, the base, the fundus, the lateral walls and the vertex or apex.

1. **Neck of the Bladder.**—The vesical outlet is not funnel-shaped but rather flattened at the small dimple in the center of a closed sphincter muscle. As one withdraws the cystoscope the roof and sides of the neck cross the field as a curtain, while the floor, in both sexes, is less distinctly demarked from the rest of the viscus, owing to the fact that the muscle is at this point more fixed by the prostate in the male and the vagina and cervix uteri in the female. With brilliant illumination the mucosa of the roof and sides is translucent and the normal longitudinal folds created by the muscles look almost like polypi but are distinguished from them by being broadly sessile and not pedunculated, by having no bloodvessels of prominence entering them, by having no mucous strings attached to them, by changing their form with muscular action, and by gradually merging into the surrounding mucosa. They are not signs of disease at all.

2. **Trigone.**—This anatomical part is the anterior segment of the floor of the bladder extending from the urethra to the ureters. The former marks its apex, the latter the angles of the base and the inter-uterine fold comprises the base itself, as a rule about 3 cm. in length.

In the sitting posture the trigone recedes below the horizontal plane a little, while in the recumbent position this angle is nearly 45 degrees. When the ureters are reached the floor of the bladder again droops backward a little into a secondary pouch of shallow depth, unless the plica interureterica and the courses of the ureters through the bladder wall are unusually prominent, when the depth of this droop may be considerable and easily harbor small stones, especially near the ureter.

The vascularity of the trigonum is so marked that individual vessels can hardly be distinguished and that the color is a low, more or less uniform, red. This part of the bladder is elevated slightly above the surrounding level of the viscus and is convexed in contour by the prostate in the male and the cervix uteri in the female. Its surface is ordinarily smooth, although one gains the impression that the mucous membrane is not quite so firmly attached as elsewhere in the bladder. Close to the neck longitudinal and radially arranged rugæ or folds appear leading from the neck and produced by the purse-string action of the cut-off muscle where it is looser than a little farther back.

Deformations of the trigone proceed chiefly from its annexa and vesical disease. In the male the prostate and seminal vesicles, and in the female the vaginal wall in cystocele, and the neck and body of the uterus through displacements and descent, may distort the trigonum into any conceivable form, position and direction. Similarly the scars and infiltrations of inflammation and other disease may also render it recognizable with difficulty.

**3. Mouths of the Ureters.**—The course of the ureters through the bladder wall is from behind forward, inward and downward so that where they meet the wall of the bladder their openings are necessarily oblique through the angular relation of their axis to the vesical surface. The normal meatus of the ureter resembles very closely in miniature the vulva of an infant, the slit of the meatus is directed from behind forward and inward and the lips are commonly in close apposition unless opened during the discharge of urine.

The ureteral meatuses are situated at each angle of the base of the trigonum at the average distance of 2 cm. (1 cystoscopic field) behind the urethra, at an interval of separation of 3 cm. (a little more than a cystoscopic field), and in size average 2.5 mm. They are usually connected by the plica ureterica as it forms the base of the trigonum and the continuation of the prominences in the bladder wall made by the ureters in their course through it. The plica may be scarcely discernible or may be so prominent as to constitute a real ridge in the bladder floor forming the anterior border of a shallow pocket behind it. In these cases the ureteral mouths are elevated considerably so as to resemble somewhat small nipples with relatively large openings. In other bladders the mouths are level with the floor and at times difficult to find.

The landmarks of the ureteral outlets are the plica ureterica and the posterior border of the dull red trigonum. If, as previously stated,

air bubble in the vault of the bladder, usually at its highest point the middle line, is surely recognized, and the instrument rotated through 180 degrees to the middle line of the floor of the bladder, but increased or decreased penetration of the cystoscope will soon locate either of these two landmarks. The field is then made to travel through each landmark across its middle—a manipulation which almost immediately locates the ureters.

The form of these openings resembles, as stated, the infant vulva and should always be studied under a rotating cystoscope. In other words, it is best to get the instrument directly over the ureter and carefully focussed and then to rotate it in order to obtain a lateral view of which will permit judgment of elevation, excavation, patency and other disease processes. Occasionally a bit of the lining of the ureter at the mouth may be seen especially with the newer models of close vision instruments such as the Buerger cystourethroscope, the Pilcher and Acmi convex sheath cystoscopes.

The vascularity of the ureters is important in that commonly a blood vessel of considerable size emerges from the mouths or close to them. About once in two or three minutes the healthy ureteral mouth will open through muscular action and discharge urine, the quantity, quality, direction of flow and distinctness of which should be carefully noted and compared with the opposite ureter. If the urine is considerably heavier than the distending medium it will usually flow along the floor first, which in the inverted image instruments appears to be backward and upward instead of forward and downward, as in the erect cystoscopes—a distinction which must be familiar to the operator. The quantity of urine at each evacuation is usually 2 or 3 c.c., the normal quality is clear unless blood, pus and detritus are present and the distinctness of the flow depends upon the comparative color as the urine enters the medium.

The patency of the ureteral openings is important and varies from normal, somewhat firm, apposition of the little lips in health, to gaping "golf hole" meatus of tuberculosis, and the irregular distortions of form due to prostatic and uterine disease, for example.

The diameter of the ureteral openings is in adults rarely over 7 F. It may be 5 F. or 4 F. and in children proportionally smaller. There is frequently a difference between the two sides so that one ureter may receive the 7 F. catheter and its fellow one of smaller caliber.

The act of locating the ureters in health is easy with any standard cystoscope, whether direct field or indirect field of the lateral, retrograde or anterograde types. If, however, the floor of the bladder is deformed, the openings of the ureters may be most difficult to fix satisfactorily in the field. The convexity of the floor due to the prostate or uterus frequently requires the retrograde telescope with the instrument penetrated to considerable degree. Sometimes the lateral lobes of the prostate suggest a close vision instrument; thus the effort to find these very important structures must not be abandoned until all ordinary means have been exhausted. Additional distention of the bladder or change



in the position of the patient will often permit study of ureters previously out of view.

Inflammation of the bladder may, through diffuse redness and edema, mask all the landmarks of the ureteral openings. The operator should then place his field at the approximately correct point and wait for the discharge of urine to make the diagnosis. It may even be necessary to administer indigocarmine or other dye to facilitate this process.

**Changes in the Form, Size and Surface of the Normal Vesical Cavity.**—The form of the bladder varies more frequently in females than in males through the bulging of the rectum in the chronic constipation to which women are so subject, through the wide variations in the size, form and position of the uterine body and cervix, and through the common diseases of the annexa. Any of these may change the form of the cavity from any direction. In males the prostate and seminal vesicles have a similar influence, chiefly, however, from the floor only and slightly lateral. In both sexes the infantile or conical form of bladder may persist so that it is very difficult to reach and examine the apex. In childhood this is one of the difficulties regularly encountered.

The size of the bladder in women is greater than in men, from a third part to a half-capacity, so that discomfort begins in the female at 300 c.c. and in the male at 200 c.c. The extreme limits of bladder capacity may be as little as 100 c.c. or as great as 1000 c.c. without valid anatomical explanation except actual embryological development.

The surface of the vesical interior varies according to the portion observed. The trigonum may be elevated through anatomical structure or convexed through extravescical organs, especially the prostate and the uterus. The ureteric and interureteric folds may be unusually prominent, even forming shallow pouches commonly posterior, sometimes anterior to them. Trabeculations may make the surface of the bladder uneven and are of two forms: the permanent and the temporary. The latter are seen in youth and are due either to anatomical muscular arrangement or momentary action across the field of vision. They are distinguished from fixed trabeculations by the fact that the mucosa is normal, and the irregularities disappear under distention and change their arrangement and relation under the observing eye. Permanent trabeculations, on the other hand, mark the bladder of old age, of prostatitis and of urethral stricture, through the chronic cystitis commonly present in all these states. The mucosa in these cases is therefore unhealthy, the trabeculæ large, prominent, unchanging and separated from each other by pouches of various depths which are difficult to illuminate. Distention and muscular action make these trabeculæ more apparent.

Pouches in the wall of the bladder may represent true or false diverticula. True diverticula are actual, anatomical abnormalities, are not removed by distention, have no trabeculæ bordering their mouths, are usually unassociated with cystitis, vary within narrow limits as to the size and form of their mouths, and may be explored with the cystoscope as individual pouches offset from the bladder. False diverticula of the

bladder are really pouches of large size associated with extreme trabeculation and are therefore small herniations of the bladder wall between the trabeculae, unaltered by increased distention except to accentuate their characteristics. True diverticula may be seen to distend uniformly with the bladder in many cases. One form of false diverticula occurs in nervous subjects by a muscular wave which will gather the bladder into an upper and lower segment with a more or less narrow isthmus between and with little or no illumination of the upper segment—a kind of hour-glass condition. The writer has had one such case which disappeared under patience and increased distention.

## II. THE DISEASED BLADDER.

### INFLAMMATIONS AND INFECTIONS.

**General Principles.**—The universal law of all mucous membrane applies to the urogenital tract as everywhere else in the body, namely, that it cannot be diseased beyond certain narrow limits without suffering damage above the power of man or Nature to cure. Practically all diseased process in the bladder expresses itself as inflammation of various degrees, beginning with simple hyperemia and ending with acute destructive and chronic productive forms. The mildest forms of cystitis are therefore evanescent hyperemias which may not even reach the stage of obliterating the individual bloodvessels under the cystoscope. More intense cystitis is accompanied by exfoliation of epithelium, the exudation of pus and mucus, the masking of bloodvessel outlines and submucosal or supramucosal hemorrhage. The most severe inflammation of the bladder extends exfoliation of epithelium to necrosis so that superficial or deep ulcers occur and cicatrization represents their healing, which may be followed by chronic productive inflammation.

The action of the urine on the diseased mucous membrane is not beneficial inasmuch as the same factors which infect this tissue also change the urine in its chemical composition, reaction and specific gravity. Thus substances which are normally in solution in the urine precipitate out, notably phosphates in alkaline urines, urates and uric acid in acid urines. Such deposits may lie upon the floor of the bladder as mechanical irritants, or by combining with plugs of pus and mucus form the nuclei of calculi, which by pressure and attrition only augment the inflammatory process. Cautions of instrumentation of the diseased bladder comprise the following rules:

1. The fewest possible invasions—one instrument for the greatest number of purposes being best.
2. Urine should be in the bladder in inflammation and nervousness to avoid irritation of the walls with the instruments.
3. Irrigation of the bladder should be done with small quantities, gently and frequently repeated, of bland, unirritating solutions under easy and full evacuation and never to the point of pain or distress.

4. If the patient, especially a male, has never had a metal instrument passed through the urethra the first invasion had best be done with a soft-rubber catheter.

From the foregoing principles it follows that whenever conditions permit, the cystoscope alone should be gently introduced while the bladder contains urine, which is easily evacuated at the withdrawal of the obturator. The cavity may next be flushed through the empty sheath if the vigor of this method is not contraindicated; or the telescope may be seated and then the irrigation proceed through the inlet and outlet faucets. Finally the desired degree of distention is secured and the cystoscopy proper begun. During these steps the cystoscope should be held as much at rest as possible with the fenestrum away from the bladder floor to avoid excoriations. This is ordinarily preferable to the "two journey" plan, called for by the nonirrigating cystoscopes which require all preparation of the bladder to be done with a catheter first. Sometimes this extra manipulation induces spasm of the sphincter difficult to overcome.

**Varieties of Vesical Pathology** include anatomical abnormalities, inflammations, neoplasms, traumatisms and concretions. Deviations from the anatomical normal of the bladder may involve any part of this viscus or of the ureters. The inflammations may follow the type of general purulent infections of which that due to the *Bacillus coli* is common and momentous, or the type of specific invasions of which tuberculosis is always in mind. Neoplasms include benign forms such as vesical, cysts and fibromata, and malign varieties such as cancer in all manifestations. Vesical trauma embraces mechanical damage incidental to accident and operation which is frequently encountered; thermal injury through scalds of too hot irrigations, which are rarely seen; and finally, chemical burns through concentrated solutions, which are likewise uncommon. Concretions is a term implying all forms of calculi in the bladder of various number, size and composition including plugs of mucus and pus as well as precipitates from the urine.

**Areas and Extensions of Vesical Lesions**, strange to say, follow almost regularly the subdivisions of this viscus recognized for anatomical description, usually in the following order: neck, trigonum, floor behind the trigonum, ureteric openings at the angles of its base, fundus, parietes and apex. A single small or large area of the mucosa may be inflamed or similar spots may be scattered everywhere, while the remaining parts are absolutely or comparatively healthy. One or more zones of inflammation may be undergoing resolution while others are still in the acute or hyperacute stage. If the bladder becomes incontinent and collapsed into folds, previously healthy portions become infected by apposition with foci of disease. Thus the infection may extend by contiguity as well as by continuity along the surface of the epithelium, or through the lymphatic and bloodvessels when the bladder does not lose its containing power.

**Sources of Error in Cystoscopy.**—The normal bladder as contrasted with the diseased viscus may lead to mistakes through such simple

ors as distention, illumination, deformation, dye-stained urine, osal reduplications and the like.

distention in cystoscopy is so much a matter of habit that it is well the operator to become skilled in the appearance of the normal der during collapse or at least during partial distention. In these instances the vessels will be found of apparently wider caliber more numerous so as to redden the general color. The gloss of mucous membrane is also less because of less tension exerted on it. Increased size of the bladder cavity in partial distention brings the ous membrane nearer the objective lens, which also tends to redden general color.

Illumination of the bladder cavity with intense white light brightens redness to a distinct whitish or yellowish tone. A less clear light nits a deeper red to prevail. Inasmuch as the intensity of the light d always be fixed outside the bladder it is not advisable to change xcepting to decrease it and then return to the original point. ease in the current after the lamp is in the bladder usually burns the filament. A better test is to make the light approach and de from the field in judging color.

bjective and ocular lenses may be soiled and lead to error. A r of blood, mucus, pus or lubricant on the objective or prism may ery annoying and require withdrawal and cleansing of the telescope. ost important preliminary therefore is always to see that the lenses clean.

ormal folds of the bladder wall constituting true rugæ may deceive ss distention is employed to alter their forms, and the ureteral eter to test their attachment and depth.

Iuscular bands of prominence in the bladder may be an anatomical iarity or at any age show the results of obstruction; in youth by ture and in old age by prostatic involvement. As already pointed changes in their conformation indicate a temporary character and ence of these changes the permanent form of trabeculation. The dition of the mucous membrane overlying them is almost always lthy in the former, but diseased in the latter variety.

he course of the ureters through the bladder wall may show as nite prominences, the plica ureterica, either through hypertrophy he muscular wall of the ureters or simple anatomical size. Such are inguished from diseased conditions by the absence of the signs of nic inflammation in the mucous membrane over these promi- ces, of abnormal conditions in the ureteric mouths and of the dis- rge of blood, pus or mucus with the urine. A ureteral catheter es easily and without any obstruction through such ureters.

igh colored, normal urine, rapidly discharged into the bladder and urine of the various efficiency tests, especially methylene blue, gocarmine, and phenolsulphonephthalein, may change the appear- of the mucous membrane and require caution on this account e in use.

deformations of the normal bladder cavity by pressure from without

may be so deceptive as to require corroborative examination through the bimanual method in both sexes, concerning the prostate in men and the internal sexual organs in women.

The vesical neck may present under the purse-string action of the sphincter muscle a number of folds, reduplications or tabs of considerable size. They should be examined and their nature determined by the retrograde telescope, the cystourethroscope and palpation with the ureteral catheter or other instrument. They have no signs of inflammatory change either as hyperemia, thickening or exfoliation.

**Orthopathologic Changes.**—This term is used to classify and in a broad way describe the true pathological changes to which the bladder is subject as the expression of disease, and to distinguish them from those conditions in health as just described which may closely simulate disease.

**Location of Pathological Change.**—The mucosa as a whole or in disseminated areas, the muscularis in its entirety or in definite regions, either or both ureteral meatuses and their annexa are the commonest sites of disease, individually or in complex association with one another.

*Cystoscopic pictures or objective symptoms* are more or less similar in character but vary in degree as they accompany inflammation, neoplasm, traumatism, foreign body and vascular and lymphatic obstruction. The present section will therefore deal with the manner in which the bladder shows reactions to these conditions in a general way, while a description of the particular signs of certain diseases will be left to appropriate subsequent sections.

*Reactions in the mucosa through disease* may be classified as anemia, active hyperemia, passive hyperemia, submucosal hemorrhage, edema bullosa, and vesicle and cyst formation.

1. **General Anemia** and **Ischemia** or localized anemia of the mucosa are not very common, especially the latter. Of either gradual or sudden development they denote partial or complete interference with circulatory function. The cause is mechanical pressure or vasomotor results of cerebrospinal disease. Positive and more extreme anemia is commonly arterial and shows as focal or general pallor, whereas the venous forms are congestive and livid, rapidly passing into passive hyperemia. If the process of arterial anemia progresses, degeneration and exfoliation of the epithelium ensue with necrosis and ulceration as later developments. In the cystoscopic field these various conditions are characteristic and relatively easy to discern, inasmuch as universal anemia is very rare, except as the accompaniment of conditions which would lead one to expect it; for example, as the result of severe hemorrhage, of systemic anemia, and of the atrophy of the mucosa through the capillary arteriosclerosis of old age. Sudden obstruction to the circulation leads to momentary anemia followed by submucous ecchymosis and hemorrhage, which shows in the field as a very deep red or still darker spot, darkest where the process is oldest and the layer of blood deepest. Relative anemia of the bladder may be produced by overdistention during cystoscopy and may be distin-



guished from essential anemia by decreasing the amount of distending fluid under the eye.

2. **Active Hyperemia** of the vesical mucosa is of arterial origin and denotes a surcharge of blood at one, several or all zones of the bladder. The differential diagnosis between inflammation as such and hyperemia is in essence in the following facts: that in inflammation the degree of circulatory activity is greater; that the mucosal interarterial spaces are no longer normal; that exfoliation of epithelium and production of exudate are regularly present; and that the process as a whole does not involve the blood current alone. From this it follows that hyperemia may represent the initial or resolving periods of inflammation. The causes of active hyperemia are the same as those of inflammation but of milder degree: traumatic, thermal, chemical and bacterial. Traumatism really includes the first three factors but is, however, a term used to denote mechanical agents such as surgical instruments during examination and operation, the accidents of life and childbirth. Thermal elements include burns from cystoscopic lamps and hot irrigating fluids or the depression of cold irrigating media.

Chemical sources of hyperemia are more common and rest on concentrated strengths of nonirritating and various solutions of irritating salts, the latter much the more commonly. The bichlorid of mercury in most, and in many bladders potassium permanganate and silver nitrate, unless in weak solutions, are familiar examples of irritating salts, applied during irrigation. It is best always to use no bichlorid and the weaker percentages of the other two, as 1 in 20,000 to 1 in 10,000 for the first trials. Drugs by ingestion may cause hyperemia, especially the newer preparations which liberate formaldehyde. Withdrawal of the offending medicament is the indication.

The arterial hyperemia caused by mechanical and chemical means usually does not go on to inflammation. When, however, bacteria are the cause of hyperemia, the reverse is the case and the hyperemia is the first stage of extensive inflammation. The common germs of purulence including the gonococcus, *Bacillus tuberculosis*, *Bacillus coli* and *Bacillus typhosus* are most familiar. The degree of hyperemia is usually high, persistent, progressive and widespread, excepting the *bacillus tuberculosis* which, at least at first, causes patches of hyperemia.

The distribution of arterial hyperemia is over any one, few or many points or zones of the bladder wall, or generalized everywhere. The zones are attacked in the order of frequency as follows: the trigonum and base in the cases due to ordinary causes, the vault and sides from contact with instruments or cystoscopic lamps, and the mouths of the ureters in renal and ureteral affections, predominately suppuration, tuberculosis, lithiasis and neoplasm.

Cystoscopic pictures of arterial hyperemia show the minute arterioles increased in number and enlarged in size, approaching the diameter of many vessels constantly in the field in normal bladders. The mucous membrane over the areas between the prominent vessels is



fully or nearly normal without dulness, exfoliation, exudate or more than slight reddening of the usual color tone.

3. **Passive Hyperemia, Venous Hyperemia and Venastasis of the Vesical Mucosa** are practically synonymous terms and are conditions due to pressure on veins with resulting distention of the venules, as, for example, by the uterus enlarged through pregnancy and fibroid tumors and by pelvic exudates and neoplasms, phlebitis and thrombosis.

The cystoscopic picture of venous hyperemia is that of various degrees of cyanotic, unhealthy, swollen and edematous mucosa. Varices of little or considerable prominence may be present. This condition can never be any but localized to the area drained by a given system of veins affected. Sometimes one of the earliest signs of carcinoma of the prostate is a venous hyperemia in its neighborhood.

4. **Submucosal Hemorrhage, Ecchymosis and Petechiae of the Vesical Mucosa** denote descending grades of bleeding into the intramucosal and submucosal tissues, which accompany the severer degrees of either active or passive hyperemia.

In the cystoscopic picture they are large, small or minute extravasations whose redness depends on the recency and the penetration of the process.

5. **Edema or Serous Effusion of the Vesical Mucosa** usually follows high-grade hyperemia as the second stage of inflammation, but in fulminating cases may precede it as the first stage of the process, exactly as is the case in all other mucous membranes. The pathogenesis is the effusion of serum from the blood into the subepithelial and submucosal layers, and the exciting causes of all, those of the hyperemias, to which should be added severe inflammation in the neighborhood of the bladder. More or less lymphatic and circulatory obstruction are also underlying factors.

The cystoscopic picture is that of the mucous membrane of watery, succulent, swollen appearance, with a tendency to "pitting" under the ureteral catheters and usually with absence of bleeding when touched, unless the hyperemia is marked. The effusion as a rule masks the underlying small bloodvessels and ecchymoses unless extensive. The color of the field is therefore a soggy pale one unless a precedent hyperemia persists. The color is then red through the advancing congestion, the surface raised, uneven, tense and glossy, with here and there polypoid masses of translucent pink, and few bloodvessels.

Causes of edema additional to the general sources of hyperemia are neoplastic changes involving the blood and lymphvessels along the bladder floor through deposits in the uterus, prostate and rectum. Pressure of impacted ureteral calculi near or within the vesical parietes may extend edema along the plica ureterica into the ureteral meatus to the degree of total occlusion. Urethral obstruction from stricture of the urethra by inflammation, or by pressure of uterine enlargement or descent, or by all the prostatic diseases may cause edema at the neck of the bladder. Great irritation of the mucosa may cause edema, as that from intense changes in the chemical reaction of the urine, from the

circulatory effects or mechanical damage of pressure without or within the bladder in tumors and lithiasis, from mechanical obstruction of stricture and prostatism, and finally from the injury of accident or incident in operation. Inflammation is an essential and regular accompaniment of edema.

6. **Edema Bullosum, Edema Hydatidiforme vel Edema Vesiculosum** may be defined as circumscribed edema with formation of bullæ, blebs or vesicles of various but moderate size, closely grouped and sessile, or slightly pedunculated in attachment. The condition has been regarded as an entity but is probably a regular accompaniment and sequel of lymphatic and vascular obstruction of high focal degree. The lesion occurs more commonly in females than in males and is caused by the circulatory results of inflammation and pressure, by the actual weight of enlarged organs as the uterus and the prostate, or the more direct occlusion of inflammatory exudate and infiltration. It is therefore associated with hypertrophy and cancer of the prostate, uterus and rectum, the intense irritation of vesical and ureteral stone, the chronic inflammatory changes of tuberculosis and fistulæ and the intense reaction of hyperacute cystitis, as all these conditions affect the circulation of both lymph and blood.

The pathology of edema bullosum is the formation of serous effusion in the mucosa so as to make groups of vesicles, greatly or moderately conjoined into single or several masses. The limited groups correspond, no doubt, with the areas in relation with the smaller vessels affected, be they the radicals of lymphatics, veins or arteries. Thus the blebs may be remote from the point of actual compression as when an early cancer of the prostate excites the condition in the trigonum.

The cystoscopic picture of edema bullosum is that of a group of blebs resembling a closely attached bunch of grapes or half-capsules, distinctly demarcated from its annexa, of reddish-white to positive red depending on the amount of congestion present, of elevated uneven surface, of moderate translucency and of variable congestion. If the lesion primary to edema bullosum is relieved the mucus usually resumes more or less normal conditions; thus its importance rests on the remedial possibilities of the causative factor.

7. **Edema Trigoni Simplex or Simple Edema of the Trigonum** has been described by Pilcher in his work on Practical Cystoscopy. The writer has seen a similar condition in the urethra of women. Pilcher describes the condition as a simple, peculiar edema of the trigonum seen in women more than in men as the expression of pressure from anteversions, retroversions and enlarged cervix of the uterus, from impaction of feces, from any ordinary cause of chronic congestion of the trigonum, especially the conditions leading to irritability of the bladder in women. The writer himself has seen it in connection with cystocele with its essential hyperemia and dragging on the trigonum. Simple edema of the trigonum is not ordinarily the sign of previous infection of the bladder, ureters or kidneys. In nature it seems to be a very moderate degree of edema bullosum.

The cystoscopic picture of edema trigoni simplex is that of an edema bulbosum of moderate degree, sessile in its origin and relatively of high congestion. In the bladder and in the urethra alike it is readily relieved by gentle swabbing with 5 or 10 per cent. solutions of nitrate of silver, depending on the severity.

8. **Simple Cysts of the Vesical Mucosa** are of little pathological moment, solitary and single or reasonably numerous and scattered. They arise as the early or late sequels of inflammation and as simple vesicles by distention or retention. Mucous crypts otherwise normal may be unusually prominent and appear as cysts on lateral view, or may be true cysts by retention. Others of these simple vesicles are due to serous effusion and in this respect resemble single blebs of edema bulbosum, and when very numerous and closely grouped virtually pass over into that lesion. The neck and trigonum of the bladder are the commonest sites of their appearance.

**Reactions and Lesions of the Vesical Muscularis in Disease** include temporary and permanent trabeculations and congenital and acquired diverticula.

Trabeculations have been fully discussed in preceding pages. It is therefore necessary here only to repeat that the temporary trabeculations are functional and spasmodic, and that the permanent degrees of the lesions are pathologic and organic, and that by continuance of exciting causes the functional may become the organic condition.

Congenital diverticula are anatomical abnormalities, and consist in pouchings and offsets from the cavity of the bladder as secondary bladders communicating with the primary viscus by only one channel, as a rule. Such pouches vary in size and location, from small to large diameters and from zone to zone of the bladder wall, excepting the floor where they are practically unknown.

Cystoscopic pictures of congenital diverticula of the bladder depend on whether or not the cystoscope may be introduced into them, and whether or not cystitis as a whole is present, or diverticular retention and inflammation have occurred. A "bull's-eye" is the best description for the opening into the unilluminated diverticulum as it appears in the midst of a more or less healthy bladder wall, varying in size, blackness and distinctness largely in accordance with its annexa. The depth of the diverticulum may be tested with the ureteral catheter and in a certain sense the character of its contents known. The margins of the opening are sharp or ill defined, flat or elevated, smooth or rough, pale or hyperemic, according to the presence or absence of infection. Extrinsic illumination, that is, from the bladder cavity, is usually alone possible, because our cystoscopes are not long enough to pass into such a pouch after suitable dilatation of the bladder and itself. But some information may be gained with direct field instruments and with close study as the lamp passes the margin, giving the "shadow test;" by which a portion of the cavity is illuminated and the balance dark from the shadow cast by that part of the margin which is directly opposite the lamp and hence eclipses the cavity behind it. Intrinsic



illumination of a diverticulum is possible only when conditions permit such exploration.

The contents of small diverticula are usually evacuated with the balance of the bladder, but with larger examples the tendency is toward retention and decomposition of the urine so that mucus, pus, precipitation of urinary salts, deep-seated disease of the walls and even lithiasis occur—in short, all the conditions in miniature of prostatism and cystitis. Acquired diverticula of the bladder are pathological entities always associated with chronic inflammation and obstruction, and arising from two factors: Hypertrophy, elevation and prominence of certain muscular bands in the effort of the bladder to evacuate itself through the obstruction; and atrophy, depression and recession of the bladder wall between them; so that gradually these pouches deepen until they harbor stones of various size and show the pathology of localized retention of urine. Acquired diverticula vary in number, diameter, depth, capacity and condition of their wall and contents.

**Openings of the Ureters, Plica Interureterica and Plicæ Uretericæ.**—These anatomical features of the bladder are the next in order for description as to their pathological details. Inasmuch, however, as ureteral examination, exploration and treatment are properly considered under sections devoted to them later in the book, it seems best to leave this topic as a proper part of the subject. In passing, however, it is to be noted that the observer must distinguish the normal meatus in its muscular activity, rate and manner of urinary evacuation and annexa. He should likewise know the abnormal meatus as to its congenital anatomical malformations and reduplications, muscular action, emission of pathological urine or contents, and in its signs of disease in the annexa, mucosa, contractures, traumatisms, foreign bodies, neoplasms and special pathological processes (particularly tuberculosis).

### CYSTITIS.

**Definition.**—Cystitis is defined as any inflammation of the bladder irrespective of cause, course, distribution and termination.

**Varieties.**—Cystitis is recognized (1) as to occurrence—primary by direct focal infection, or secondary by extension in continuity or contiguity or by transmission through the blood and lymph currents of infection situated elsewhere in the urogenital tract; (2) as to course—acute, subacute and chronic and remittent, intermittent and relapsing; (3) as to cause—nonsuppurative, suppurative, neoplastic, calcareous, tuberculous, colon bacillary, etc.; (4) as to distribution—regional or local, patchy or disseminated and general or universal; (5) as to products—purulent, membranous, ulcerative and necrotic.

Regional or local cystitis may affect one or two zones of the cavity or by a multiplication of the points affected pass over into the disseminated type. Generalized cystitis may show equal intensity, diffused everywhere or may also appear as more severe in some than in other zones. The ordinary signs of mucosal inflammation occur

in cystitis, diversified in kind, degree and site; beginning in ordinary hyperemia and passing through active inflammation with patches of submucous ecchymosis and hemorrhage, with exfoliation and erosion of epithelium of different severity, with superficial and deep, small and extensive ulceration and necrosis and finally with gangrene in extreme instances.

**Subjective Symptoms.**—Cystitis varies with the intensity of the inflammation. The symptoms are discomfort or actual pain in the general bladder zone, frequency, urgency and tenesmus of micturition, pyuria and at times hematuria, especially terminal. Thus the law of all mucous membrane inflammations is followed in that irritation of the sensory nerves causes the pain and discomfort, stimulation of the spinal

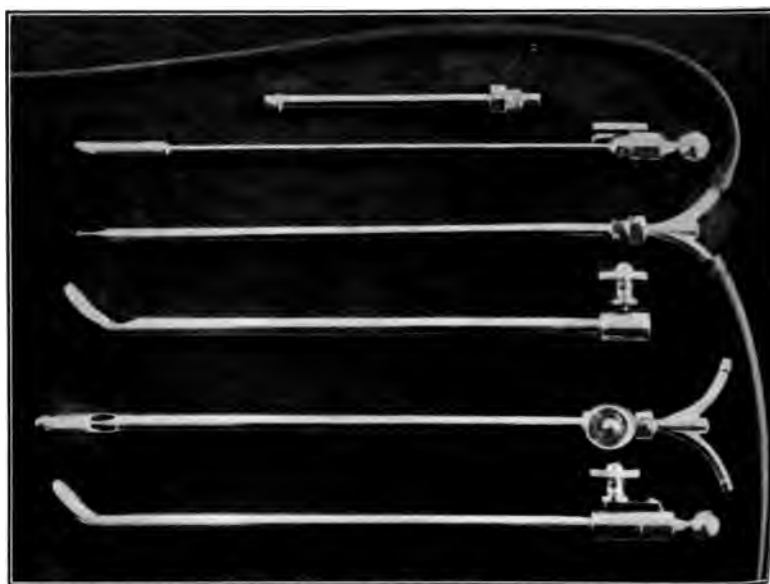


FIG. 212.—New bladder irrigator. (Peterkin.) From above down are connecting tube, obturator, double-current catheter, sheath of irrigator, assembled instrument ready for irrigation and finally assembled instrument ready for introduction.

reflex induces the frequency, urgency and tenesmus, while changes in the normal secretion and damage to the surface of the mucosa produce the pus, blood and desquamation of epithelium.

**Acute Cystitis.—Distribution and Extension.**—Acute cystitis may be focal and limited, disseminate in patches, or diffuse and universal. Localized and circumscribed cystitis as well as the disseminate and patchy variety show a mucosa normal or nearly normal at uninfected points. The several areas may be single or multiple, small or large, discrete or coalescent and finally pass into the diffuse type affecting the bladder as a whole. The original foci are circumscribed and clearly

<sup>1</sup> Am. Jour. Urol., 1909, xiii, 469.

outlined against their annexa of normal or nearly mucous membrane. Diffuse cystitis if watched under the cystoscope commonly originates in the trigonum and adjacent base of the bladder from which it steadily extends without remission.

Cystoscopic picture of acute cystitis is the same in both local and diffuse varieties except the area involved—in other words, the former is a minature of the latter. In the stage of invasion or congestion there is engorgement of the individual vessels common to the normal mucosa; this is followed by the appearance of vessels usually too small to be seen and by the reddening of the previously normal color. Next a diffuse redness without separate bloodvessels occurs with ecchymoses beneath the mucous membrane. Simultaneously the surface becomes dulled, raised and irregular and the secretion changes from mucus to an exudate of mucopus or pus, often floating in the distention medium as cotton-like clouds in a red sky. Exfoliation of epithelium gives a rough, shaggy, uneven surface and the transudation of serum causes edema, diffuse, disseminate or localized, in few or many blebs, passing over into edema bullosum. Resolution may now occur by a reversal of these various steps until the terminal congestion is reached, or the infection pass over into the intense degree, involving superficial ulceration and deep necrosis, both of various extent and of moth-eaten or mouse-gnawed appearance. The exudate now becomes mucofibrinous or pyofibrinous and the picture becomes darker as the deeper layers are reached and show thick, tenacious, adherent detritus which as it detaches gravitates to the dependent parts of the bladder and forms a thick layer in clumps and rolls, like mud at the bottom of a puddle, while the upper portions of the bladder show the signs of the intense disease in hyperemia, exudate, loss of tissue and the like.

Recovery may now occur leaving behind it the scars of the ulcers and necroses; more commonly, however, this mucous membrane after so severe a process does not resolve but goes on to chronic inflammation, or to subacute cystitis.

To the foregoing cystoscopic features should be added the bacteriologic elements, namely, the organisms causing the disease, notably the gonococcus, *Bacillus coli*, *Bacillus typhosus* as familiar examples.

**Subacute Cystitis.—Definition.**—Subacute vesical inflammation or cystitis may be throughout of degrees less severe than the acute disease, or may occur as the stage of incomplete resolution of the latter more or less indolent and mild in character. Subacute cystitis may affect a single zone of the bladder wall or several. If only one focus is its site the trigonum is most commonly involved. If several foci occur they are laid down in spots, patchy or streaky in character, varying in number, size, form and sites; with distinct tendency to favor the dependent portions—namely, the floor and trigonum, upon which infecting detritus must lie by gravitation from all other points of the bladder wall until evacuated.

Cystoscopic pictures of subacute cystitis reveal the affected areas as having dark centers, if ulcerating, and white centers if healed or



covered with tenacious exudate. Both such centers are surrounded by a halo of dull, swollen, hyperemic mucosa outside which is another halo of engorged, radiating bloodvessels. The mucosa as a whole is less glossy and more red than normal. If the base of the bladder is chiefly involved the mouths of the ureters are raised, puffy and indistinctly outlined, and the trigonum as a whole shows chronic congestion and edema.

In brief, subacute cystitis is clinically a disseminated, chronic cystitis.

**Chronic Cystitis.—General Features.**—Chronic cystites are alike in general in all forms, to which are added particular elements in the special types hereinafter described. The following are the main points:

**Distribution.**—Chronic cystitis is limited chiefly to the dependent anatomical portions of the bladder, namely, the floor and the trigonum on which the inflammatory débris lies, and the urethral outlet through which it drains—facts which invite and promote infection at these points.

The cystoscopic picture in chronic cystitis presents the bloodvessels less distinct than usual because obscured by persistent thickening of the mucous membrane and loss of gloss and translucency. The color is reddish gray instead of yellowish red from the same thickening and other changes. In spots where the vessels show through the red color predominates. In the upper quadrants of the bladder where Nature's cleansing processes are unaffected by accumulation on the surface there may be nearly normal mucous membrane here and there. The ureteral outlets share the same disadvantage as the rest of the bladder floor and are puffy and difficult to distinguish. Chronic cystitis is therefore a process which shows areas of recovery, spots of remission and patches of steady low-grade disease, variously correlated with the base of the bladder distinctly most affected. The secretion is no longer strictly such but an exudate, thick and clinging, giving to the surface a smeared, irregular, broken appearance. If the chronic catarrhal passes into chronic productive inflammation the small round-cell infiltration is often grouped in conglomerate points, difficult to distinguish from early carcinoma.

**Special Forms.**—Chronic cystitis for description is subdivided into chronic cystitis of urethral obstruction, chronic vesical cervicitis or chronic trigonitis, Knorr's chronic follicular and granular cystitis, Knorr's chronic glandular cystitis, chronic membranous cystitis or diphtheritic cystitis, hemorrhagic cystitis, chronic gonococcal cystitis, and membranous edema of the trigone of Pilcher.

The following are their features in brief:

**Chronic Cystitis of Urethral Obstruction.—Occurrence.**—This type of cystitis is far more common in males than in females and is due to stricture of the urethra, prostatism and periurethral neoplasms, in the last of which the cases in females are usually classed. The features of stricture of the urethra are properly treated in the section devoted to urethroscopy on page 667, and likewise those of hypertrophic and other lesions of the prostate are more fully described on pages 943 and 946.

the cystoscopic picture of chronic cystitis of urethral obstruction is much the same in all cases, being varied only by elements due to the peculiar cause—as given in the following list. Urethral stricture cases comprise also the chronic urethrocystitis associated with the obstruction. Extravesical and extraurethral tumor cases usually emphasize urinary and lymphatic stasis. Prostatic cases show a long and extended line of changes in the roof, sides and floor of the vesical neck, loss of its marginate relation to the bladder cavity; irregularities in the floor of the bladder due to the enlargement of the gland; infiltration of the trigonum due to the chronic congestion; and finally deformation and masking of the ureteral mouths and folds through changes in their annexa. The color is a dirty grayish-white or red, the blood vessels are hidden by the thickening in the epithelium, edema is usually present through the chronicity of the process, elasticity under distention, muscular action is decreased or absent, mucous crypts are imperceptible as a rule and the exudate is thick and mucopurulent. The most significant feature is the condition of the muscularis. Through straining in chronic inflammation a large number of muscular bands in irregular arrangement have been converted into permanent trabeculae through gradual hypertrophy, some being very large and others much smaller. The spaces between these bands have by reversal of process become obliterated, weakened and even herniated so as to comprise permanent dilated diverticula. These pouches show any limit of diameter, depth, distribution and degree of disease in their cavity, depending chiefly on their capacity to empty themselves. Many of them cannot be illuminated with the lamp and explored. Not infrequently they contain calculi in the later degree of the cystitis. The more severe lesions are usually lowest down in the bladder cavity and the variety is so great that no brief description is adequate; in short, any ordinary chronic inflammatory process may be present at one or more points, catarrhal, suppurative, productive or necrotic, and progressing, stationary or resolving.

**Chronic Trigonitis.**—*Definition.*—Chronic trigonitis or chronic vesical icitis is a chronic cystitis confined to the outlet of the bladder and trigone. It is often the terminal stage of acute diffuse cystitis or may be a more or less distinct lesion primary in itself.

Cystoscopic pictures of chronic cystitis portray catarrhal, suppurative and productive inflammation of the trigone and cervix. In the urethral form there are congestion, hyperemia, edema and vesiculation of the affected region, with a mucoid discharge. Suppuration increases the activity of all these processes and shows pus as well as pus and detritus. Productive or infiltrative lesions show thickened mucosa, more numerous and dense vesicles and even tubercles resembling those of tuberculosis in appearance, but not in structure. The chief complaints of the patients are pollakiuria and dysuria with hematuria, especially terminal.

**Hemorrhagic Cystitis.**—*Definition.*—Cystitis is called hemorrhagic when blood appears beneath the mucous membrane or upon its surface

and is evacuated, freely mixed with the urine, or in streaks and drops upon the plugs of mucus and pus, or in the more or less pure state at the end of micturition. Almost all severe cystitis passes through a hemorrhagic period of varying intensity. Cystoscopic pictures of hemorrhagic cystitis reveal submucous hemorrhage in petechie, ecchymoses, patches and streaks as previously described. Hemorrhagic cystitis hardly deserves individual classification but sometimes the blood spots are a very distinct feature. There may be one, few or many, very large, moderate or minute in size and located almost anywhere in the bladder. The thicker the layer of blood and the older the process the darker the color, so that sometimes it is hard to distinguish almost black hemorrhagic spots from old open ulcers.

**Membranous Cystitis.**—*Definition.*—Membranous or diphtheritic cystitis produces a false membrane, usually on the floor of the bladder about the trigonum, through the deposit, coagulation and adhesion of the products of chronic suppurative inflammation to the mucosa. The lesion has nothing to do with the Klebs-Loeffler bacillus, is interesting and unimportant except for the ability to distinguish it. Detachment of the membrane leaves a granular, oozing surface beneath.

Cystoscopic pictures of membranous cystitis display a chronic inflammation with one or several patches of membrane present.

**Cystitis Follicularis et Granularis (Knorr).**—*Definition and Features.*—Granular and follicular cystitis is a disseminate, chronic, productive inflammation of the bladder resulting in numerous and more or less closely grouped tubercles not unlike tuberculous foci. Individual lesions consist of small round-cell masses with lymph and lymphocytes distributed through them and located beneath the epithelium.

Cystoscopic pictures of follicular and granular cystitis reveal deep red ground with the tubercles scattered over it. In a broad and general sense the lesion looks like trachoma of the eyelids.

**Glandular Cystic Cystitis.**—*Definition.*—Knorr terms this chronic lesion cystitis cystica glandularis and Rokitansky and Klebs herpes vesicæ urinariæ. It is a cystic degeneration of the mucous membrane during chronic trigonal cystitis, so that numerous yellow to gray colloidal cysts are produced. In another sense it is bullous edema of chronic type occurring during a chronic cystitis, and having obvious cystoscopic features.

**Acute and Chronic Gonococcal Cystitis.**—*Definition.*—The diplococcus or gonococcus (Neisser) may infect the bladder with acute or chronic inflammation. It is commonly distinguishable from other cystitis only by bacteriological investigation, which should be carried out in every case as routine. The chronic lesion usually persists in the zone first infected—namely, the cervix and trigone which the organism reaches rarely by continuity, as it does not often pass the sphincter, but commonly by contiguity through the medium of instruments and the like. The acute disease is so marked as to render examination hazardous. The declining stages show a degree of congestion, hyperemia, edema, erosion and ecchymosis which characterize gono-

infection in the urethra and suggest what must be the more advanced conditions of the stages of increment. Chronic gonococcal cystitis shows all the changes of other persisting cystitis with the added presence of the gonococcus in the shreds and pus—variously distributed foci of inflammation, infiltration, exfoliation and erosion most marked at the outlet of the bladder.

**Tuberculous Cystitis.**—**Definition.**—Tuberculous cystitis is a sub-acute or chronic infection of the bladder with the bacillus tuberculosis, occurring exceptionally as a primary lesion but almost universally as a complication secondary to tuberculosis of the kidney. It is most commonly localized in one, occasionally disseminated over several and very rarely diffused over all areas of the bladder. In the former there is always an associated infection—germs other than the



13.—Tuberculosis of the bladder and ureter. The cystogram shows a contracted bladder, whose degree prevented successful cystoscopy and ureteral catheterization. Fifty per cent. argentic solution was employed, which apparently overcame the spasm of the ureter and forced past the ureter on the diseased side, giving a beautiful ureterogram. (but futile attempt was made, in the hope that a pyeloureterogram would result. See case.)

of tuberculosis—which excites the generalization of the cystitis and creates the field for the rapid extension of the tuberculosis.

**Symptoms.**—Tuberculous cystitis has, even in the secondary stage, not renal but vesical symptoms and of intractable, intense, progressive degree. They are chiefly nocturnal and diurnal pollakiuria, tenesmus, stranguary, pyuria and hematuria. Two important facts stand out in bold relief against common experience in other forms of cystitis compared with tuberculosis—namely, treatment is of no benefit and a primary focus outside the urogenital system is almost impossible to find.

For the purposes of clinical convenience therefore it is proper to treat such cases as primary in the urogenital apparatus, although no definite lesion elsewhere cannot be found. The vast number of

autopsy findings, however, showing healed tuberculous foci in the lungs and digestive tracts, make it likely that pathologically many of these cases are strictly secondary.

**Urinalysis.**—In tuberculous cystitis the urine is highly important and distinctive. The specific gravity is rather low, the reaction is acid, the pus prominent, thickish, tenacious in the later, rather flaky in the earlier stages, and smearing the surface of the container much as does sour milk. The absence of other pus-producing organisms in the urine is a peculiar and almost pathognomonic point. Numerous red blood cells and a few drops of terminal hematuria are also notable. Given these features, the *Bacillus tuberculosis* should always be looked for by smear, culture and inoculation tests with a distinction between the



FIG. 214.—Advanced urogenital tuberculosis. Typical bullous edema of the trigone and deep urethra in continuity; diagnosis repeated by urethroscopy. (McCarthy.)

bovine and human varieties when possible. The guinea-pig test, awaiting the death of the animal through tuberculosis, is final. A more rapid and equally reliable method is to inject the fluid into the thigh and after three or four days, instead of as many or more weeks, examine the lymphatic glands of the groin for tuberculous inflammation.

**Pathology.**—Tuberculous cystitis follows the same form as everywhere else in the body and shows a period of early invasion with the formation of tubercles, then a period of early infiltration with superficial ulceration of the tubercles in the midst of the chronic mild productive inflammation. Next is the stage of deep infiltration and extension followed at last by extensive excavating necrosis. It will be noted that the degree of infiltration through the small round cell production and

cutting off of the blood supply determines the depth and extent of ulceration. In other words, the process duplicates itself in form and differs in degree. This, in brief, is the description of the disease as detailed in the more detailed statements of authorities like Halle and Motz.

**Endoscopic Pictures.**—Tuberculous cystitis resembles all other forms of chronic cystitis with the added features of the tubercles and the ulcers. Invasion of the bladder is necessarily very difficult and painful even in the earliest stages, as the bladder is irritable and intolerant of tuberculosis to a degree often disproportional with the lesions found. As the urine is clear or reasonably so it is often well to attempt the distention with it as the medium of distention. Inasmuch, however, that patients with tuberculous bladders seek aid on account of hematuria and pyuria this plan cannot be adopted. Local, that is, vesical anesthetics, are also out of the question through the intolerance; therefore



FIG. 215

FIG. 216

FIG. 215.—Posterior urethral tuberculosis. Right tuberculous epididymitis; operation not advised; benefited by fresh air life; diagnosis corroborated by urethroscopy. (Carthy.)

FIG. 216.—Posterior urethral tuberculosis. Renal tuberculosis; occluded ureter; negative urine; diagnosis confirmed by urethroscopy. (McCarthy.)

Endoscopic cystoscopies in this disease require a general anesthetic, or local anesthesia by spinal or sacral administration. The operator must usually content himself with moderate distention and, in the presence of copious appearance of blood and pus, with in and out irrigation through ureteral catheters as previously described, thus clearing the field as he proceeds.

The appearance of the mucosa is that of any other chronic inflammation with distinct tendency toward severity, infiltration and thickening.

Tubercles are an important and prominent element in various stages of development, so that the older examples have ulcerated tops which may be replaced by ulcers in the midst of groups of tubercles of newer growth. The fact that vesicle lesions are secondary to renal disease determines groups of tubercles around the ureter on the affected side.

The disease usually spreads slowly so that only a small area may be found to correspond with very severe suffering. Forerunners of well-developed miliary tubercles are little nodes and cysts filled with gelatinous



nous and grumous matter and sometimes surmounted with granulations or superficial ulcers.

Typical miliary tubercles in the bladder appear toward the end of the early invasion as small, roundish, pearlike elevations, scattered more or less lawlessly over the base, or slow increase in size and prominence and in various stages of development. The older tubercles are less white than the younger, which on oblique illumination are translucent with a yellowish center. Increased infiltration loses this appearance and induces opacity which precedes ulceration or accompanies it. The tubercles are set in annexa of pale rather than hyperemic tissue due to the infiltration of small round cells and tubercle tissue. Tubercles massed close together may merge into single larger deposits of tuberculosis which with the increasing infiltration break down into ulcers of considerable size. A characteristic of the disease is that all possible stages and appearances are detectable with care, such as: tubercles of small, medium or large size with all tones of color from pearly white to purulent yellow, with all degrees from translucency to opacity, with various superficial or deep ulcerations and with signs of steady progress or healing.

Compound tubercles or nodes in the bladder go with excess of inflammation around their sites and with coalescence into a common area or zone of tuberculous infection within whose boundaries any or all of the foregoing features are present.

Necrotic or ulcerative tuberculous inflammation of the bladder adds to all the foregoing features prominent, productive and infiltrative changes with secondary necrosis and ulcerations which may be superficial or deep. The older the process the more pronounced the thickening and the excavation. Such are seen where the infection is commonly oldest, namely, around the mouths of the ureters and the folds over and between them. The characteristic tuberculous ulcer is as follows: The infiltration produces elevation of the ulcer as a whole even after the tubercle from which it originated may have been completely destroyed. The outline is utterly lawless and irregular, the edges raised, undermined and thickened and the base mouse-eaten, irregular, indolent and necrotic. As the urine is acid there is very rarely any phosphatic or other crystalline deposit upon the ulcer. Some ulcers are healed leaving dense scars, others in the process of healing and still others continuing their destruction—in severe degrees of tuberculosis of the bladder.

**Differential Diagnosis.**—Just as the cystoscopic features vary so the early prominent symptoms of vesical tuberculosis differ, and from the pathological changes one can very easily see why some cases at first show an early, mild, subacute course with little urinary change, others with extension and development are more severe with pyuria as a prominent feature, and still others with precocious ulceration show hemorrhage as the prevailing sign.

The predominant feature of tuberculosis of the bladder is intractability to all ordinary treatment and should therefore always come into mind when such treatment fails in any case.

opathic, subacute cystitis during or before midlife, unexplained story or examination for primary focus, and unrelieved by treatment suggests four lesions: calculus, solitary vesical ulcer, new growth tuberculosis. The cystoscope will distinguish each from the other with ease, as a rule, combined with its adjuvants radiography, lysis, bacteriologic smear, culture and inoculation. Tuberculin ment may benefit or reaction to it may aid in the diagnosis. Pirquet's test is not final but may be helpful and suggestive.

Idiopathic, severe cystitis at any period of life without definite relation in history or examination, and without benefit from good management, and with pyuria, having the distinctive qualities of the type of tuberculosis previously described, emphatically implies infection with the bacillus. The cystoscope will aid in showing numerous diverse lesions. Idiopathic hematuria in the midst of moderate severe cystitis frequently suggests thorough investigation for tuberculosis of the urinary tract, especially kidneys and bladder. Most commonly the hemorrhage is found to proceed from the kidney, occasionally from the bladder, through erosion of a necrotic tubercle into a blood vessel of some size. The cystoscope will, with or without irrigation, permit one to recognize the presence of neoplasm, oozing from the ureter or bleeding from a tubercle as the source of the blood. The operative cystoscope is of signal service in these differential diagnoses in that with the biting forceps a whole tubercle or other small lesion may be removed and histologically studied. Such a procedure clarifies the diagnosis enormously and with proper judgment and conservatism is the method of first choice.

**Treatment.**—The measures in tuberculous cystitis vary in the mild, moderate and intense cases. A diagnosis once established suggests tuberculosis of the kidney of either or both sides. Some mild cases may be benefited by tuberculous bacterins, especially the bacillus emulsion regularly, regular and ascending dosage every three days, after the method of Trudeau.

Advanced cases are more serious, and with both kidneys involved, less. With one kidney involved a nephrectomy may be done with caution not to infect the wound with tuberculosis and not to leave much of the ureter behind. The removal of the main foci above the bladder to heal spontaneously as a rule.

Solitary tuberculous vesical foci indicate destruction of the tubercles and the ulcers, which may be carried out with the operating cystoscope and the Oudin or d'Arsonval current, various chemical caustics, or forceps, with cauterization of the base left behind. Generalized cystitis is benefited with emulsion of iodoform in glycerin.

Extensive destructive disease of the bladder may be benefited by irrigation when the zone is favorably placed for it. But such an operation is fraught with the danger of infecting the wound and even the system. Suprapubic drainage to rest the bladder from spasm is often resorted to and only resort and soon leads to extension of the disease along the path of drainage. Morphinism for the relief of pain is the last resort for these unfortunate victims.

In combination with the foregoing management with bacterins and various surgical procedures, all the modern details of dietetic and hygienic treatments should be added. When possible, climatic change should be secured, which is at least always feasible to the degree of plenty of fresh air in the living and sleeping quarters. In other words, as in tuberculosis elsewhere in the body, the disease should be attacked not only by local attention but also by building up the resistance of the patient's system in every practicable way.

**Cystitis Senilis Feminarum.**—Under this heading Charlton<sup>1</sup> reports about 50 observations during fifteen years of practice. The causes seem to be advanced life, frequent childbearing, lowered vitality and exposure. It has no relation with sexual life or urinary obstruction as in prostatics. Its onset is gradual, long after menopause, usually in multiparæ and is characterized by ardor, frequency and tenesmus. Only 1 case was in an unmarried woman. The course is chronic through the rest of life, varying in distress and comfort. Exacerbations for weeks, severe, disturbing and depreciating may be followed by months of comparative relief. The termination is without recovery as the disease is atrophy. Charlton has had no autopsies. He noted the urine as clouded with mucus and pus but rarely bloody and never thick orropy with strings of pus and mucus. No specific bacterial infection has been determined, but the *Staphylococcus pyogenes* is common with the *Bacillus coli* and its allies. An undetermined chain bacillus is found. The smegma bacillus is always a contamination, if present. The *Bacillus* of tuberculosis was never found. Wassermann's blood test has been negative in cases seen since the introduction of this test. Cystoscopy reveals a bullous edema sharply outlined in healthy mucosa similar to herpes zoster in the skin. Later pigmentation occurs. Vaginoscopy and proctoscopy both reveal allied lesions in their respective canals. Senile vaginitis is familiar and is usually regarded as atrophy in the submucous tissue followed by further atrophy in the epithelium and then by erosions and ulcers. The advent of bacteria augments these briefly outlined conditions. The picture of the bladder in these duplicates that in the atrophic vagina after such secondary infection. The rectum, according to Charlton, variously shows multiple punctate erosions and large distinct punched out areas. It shows deeper injection than the bladder and larger areas of degeneration, perhaps from fecal irritation and traumatism. Urethroscopy was done in two cases and showed analogous conditions in the urethra. Charlton regards the disease as homologous and analogous with senile bronchitis, conjunctivitis and nasopharyngitis, but it does not occur in the male in his studies. The only treatment is hygiene, support, argyrol instillations, alkaline douches for the vagina and rectum and five to ten drops of pure guaiacol three times a day internally or similar mild measures. Nothing surgical may be attempted.

<sup>1</sup> Tr. Am. Urol. Assn., 1916, x, 40.

## PLATE XI

FIG. 1



1. Presenting vesiculopapular elevations typically observed during acute exacerbations—associated diffuse inflammation.

FIG. 2



2. Apparently pigmented, patchy, ecchymotic appearance seen during interval period. This case has previously shown the lesion seen in fig. 1.

Cystitis Senilis Feminarum. (Charlton.<sup>1</sup>)

<sup>1</sup>Trans. Amer. Urol. Asso., vol. x, 1916.

The cystoscopic picture of traumatic vesical ulcer is that of similar lesion in any other mucous membrane, namely, a firm to thickish, irregular, shallow sore with slightly elevated but punched rather than undermined edges and a granulating base, quite smooth and of pale yellowish-red color. A halo of active hyperemia is next to the ulcer and prominent bloodvessels are everywhere abundant.

**Typhoid Ulceration.**—Typhoid ulceration is rare, always occurs with a present or recent history of enteric fever, complicated with pronounced cystitis. The appearance of the lesion is like that of typhoid ulcer in the intestine. Diagnosis is made by the history, the presence of the *Bacillus typhosus* in the urine and the character of the Widal reaction in the blood.

**Solitary Vesical Ulcer of Fenwick.**—This ulcer is clinically a chronic, indolent, focal necrosis closely resembling a tuberculous ulcer and at times impossible to distinguish from it excepting through the following



FIG. 217.—Cystoscopic ulcer or burn. The slough is apparent in a basis of inflammation and edema. The enlarged bloodvessels are significant. (Knorr.<sup>1</sup>)

differential points: the detection of the *Bacillus tuberculosis* or tubercle tissue. The urine will sooner or later contain the organism for morphological inspection, and the inoculation of guinea-pigs either into the peritoneal cavity for death in six to eight weeks or into the thigh for tuberculous lymphadenopathy in one to two weeks will demonstrate the identity of the organism found. By a still more modern method a small deep piece from the margin of the ulcer may through the operation cystoscope be removed, sectioned and shown to contain tubercle tissue if not the organisms themselves. These solitary ulcers are also distinguished from tuberculous necrosis and from cancerous ulceration by their somewhat greater and more rapid tendency to heal with resultant cicatrization, contracture, deformation and irritability of the bladder, chiefly through the chronic cystitis which may never get well. Fenwick compares solitary ulcer of the gastric and vesical

<sup>1</sup> Die Cystoskopie und Urethroskopie beim Weibe, 1908, p. 214.

e along the following general lines: Each is near an orifice of pective viscus. The bladder lesion is near a ureter and the h lesion close to the pylorus. Each ulcer occurs, as a rule, singly in the mucosa itself or in a lymphatic node. Each ulcer has a t tendency by extension to erode into bloodvessels and cause g as a prominent recurrent or persistent symptom. Both and vesical ulcers if healed leave deep infiltrating scars which arden, contract and deform their immediate annexa, which es especially important if stenosis of the pylorus or ureter ensues. hese classes of ulcer commonly appear in midlife or earlier and o be without well proved, definite cause. The bladders of men e stomachs of women suffer most frequently. The normal con- f both viscera are changed, that of the stomach being hyperacid at of the bladder alkaline.



1.—Tumors of the bladder. Adherent blood clot, simulating infiltrated tumor. (Marion, Heitz-Boyer, Germain.)

cystoscopic picture of solitary ulcer of the bladder shows a from 2 to 3 cm. across, not very deep or even shallow, irregular, infiltrated but not undermined edges and an eroded, sloughed base. Cystitis is always present, the urine is usually alkaline deposit of phosphates may be present on the sore.

symptoms of vesical ulcer are dysuria, pollakiuria and hematuria associated with pyuria and phosphaturia.

eties of cancerous ulcer may be recognized as four: (1) cancerous or necrosis; (2) superficial cancerous ulcer; (3) indurated cancer; and (4) fimbriated or fungoid cancer.

**Cancerous Ulcer or Necrosis.**—Cancerous ulcer and necrosis give the following symptoms by stages: During the period of invasion and late involvement irritability and pollakiuria predominate. As the neoplasm has reached the stage of necrosis suppuration and infection intervene. Pain which previously was indefinite is at present positive, lancinating and suprapubic or referred to the urethral meatus. Hematuria sooner or later appears with extension of ulcer into the level of the larger bloodvessels and the necrosis

<sup>1</sup> Loc. cit.



produces shreds of sloughing material. A peculiar odor of rotten meat shown by the urine is proof positive of cancer. Instead of active hematuria the slugs of mucus and fragments of tissue cast off may be spotted or streaked with clots. As soon as the new growth possesses size and weight it acts as a foreign body and produces sudden pain and tenesmus at the end of urination as do likewise the plugs of mucus and tissue cast off.

*Superficial cancerous ulceration* is pathologically an epithelioma affecting principally the base and the trigonum, growing at first slowly, later more rapidly, beginning and extending superficially in its early history with infiltration and deep fixation later. The edges are thick, raised and everted in a higher degree at some points than others. Like epithelioma of the lip, for example, its onset is either as a white, dense spot in the mucosa with bloodvessels distinctly running into it, or as a nodular deposit. In a short time, as a rule, both break down in the center as open ulcers.

*Indurated, cancerous nodule* affects the base and trigonum as does epithelioma but differs from it in being a rounded, raised tumor or tubercle of unmistakably rapid growth, of deep involvement of the annexa and underlying parts and of rather early fixation. When its ulcerative stage appears the focal necrosis is deep, thick, infiltrated, tubercular and nodular, having uneven, prominent, everted, thick and hard edges. Later a mucopurulent or hemorrhagic sloughing appears with shreds, strings and masses cast off and also a very foul odor of decaying flesh to the urine. Intense cystitis, which casts off coagula of blood, pus, mucus and necrosed shreds, always supervenes.

The symptoms of nodular, cancerous ulceration are in the early stages pain and irritability of the bladder without cystitis, while during the stage of necrosis the pain is increased and fixed and there are present pollakiuria, dysuria, pyuria, tenesmus with terminal hematuria, sloughs acting as foreign bodies and in short every possible condition of profound and severe chronic cystitis.

Nodular cancerous ulcer may pass rapidly into the fungoid type.

*Fungoid cancerous ulceration* repeats all the foregoing features with the addition that the edges and sometimes the body of the growth erupt into excrescences of the general fungoid appearance not unlike papillomata grouped around an open sore, or the growth may be papillary at the outset and later necrose at one or many points.

**Neoplasms of the Bladder.—Variations in Symptoms.**—Variations in symptoms range between "silent" growths which for a long period of their early history produce a few insignificant symptoms, and "rampant" growths which early, late and throughout their course show several or many usually severe symptoms. Thus it is that routine cystoscopy carried out for the sake of putting the touch of finish on urogenital diagnosis often discovers new growths of the bladder which had previously never manifested their presence by either subjective or objective symptoms.

**Diagnosis.**—The diagnosis may be reached on the old general principles by which objective vesical symptoms were formerly judged, not infrequently, however, with misleading or positively erroneous results. In cases of doubt exploratory cystotomy was the last resort, but not uncommonly failed to distinguish vesical from renal hematuria. This operation is today almost obsolete.

**Cystoscopy.**—Cystoscopy in neoplasms is the new and in many respects the final advance in objective diagnosis, as it brings the observation of the investigator directly to the lesions and requires only the proper experience and interpretation to become absolute. It is not without many difficulties, chiefly due to infection, hypertrophy, irritability and intolerance of the bladder, bleeding and mechanical obstruction by growth. Removal of these obstacles is commonly brought about by deliberation, patience, styptics and anesthetics, locally to the urethra and bladder or to the entire urogenital nerve supply through spinal and sacral administration.

The cystoscopic diagnosis of new growth is scarcely complete unless the number, site, size, attachment, infiltration, appearance and general condition of each neoplasm is recognized and recorded. The best method of record is that of plotting the offending growth or growths on an outline anatomical chart.

Examination and record of the neoplasms as complete as this will ordinarily indicate also the course of treatment such as intravesical cauterization with the Oudin and d'Arsonval currents or intra-abdominal removal extraperitoneally or intraperitoneally by partial or complete resection of the bladder.

Preparation for cystoscopy implies systemic and local measures. The systemic means are catharsis, bodily and nervous repose in bed for twenty-four hours, vesical repose by light diet and cleansing with urinary antiseptics. All these are not always possible but should be borne in mind and applied when circumstances permit.

Local preparation includes irrigation of the bladder with bland, rather hot, fluids, which are solvent of pus and blood at first and later mildly styptic and finally anesthetic. For this purpose no anesthetic is better than 2 per cent. alypin retained fifteen minutes. Water is essentially the best medium but if the bleeding is so rapid as to cloud it immediately air and oxygen may be substituted. A very valuable preliminary is to insert the instrument into the distended viscus whose separated walls usually carry the neoplasm away from contact with the instrument which avoids bleeding. Obstacles to cystoscopy comprise those proceeding from the bladder as a viscus and those from the new growth as a foreign body. The bladder as a viscus is sooner or later infected, irritable, incontinent and hypertrophied all in various degrees. These symptoms render it most difficult if not impossible to carry out irrigation, distention and, of course, instrumentation. The cystitis may produce a real incontinence from the presence of pus and detritus on the bladder floor and from changes in the urine by which precipitation is determined.

The tumor mass acts as a foreign body and induces many of the foregoing obstacles from the bladder and may itself become a barrier into which the lamp may be buried during the introduction or it may actually obstruct the introduction of the cystoscope. Usually such tumors of the bladder may be recognized by bimanual examination in both sexes.

**Varieties.**—Vesical neoplasms include (1) among the benign forms fibrous papilloma, villous papilloma, myoma and fibroma and (2) among the malign forms carcinoma of papillary, fibrous, infiltrating and colloid types and sarcoma of infiltrating and noninfiltrating types and (3) among transitional forms adenoma and myxoma.

**Benign Fibrous Papillomata** are as a rule solitary, situate in any part of the bladder, from pea-size to egg-size (0.5 to 6 cm. in diameter), nodular in surface, irregularly spherical in form, pedunculated in attachment, fibroid in constitution, benign in course and usually "silent" in symptoms so that they are incidentally discovered during cystoscopy for other purposes. Their mobility on their long pedicles permits them to wave about in the contents of the bladder so as to accommodate themselves to its muscular action, ordinarily without symptoms. They thus strongly resemble uterine fibroids. Their vascularity is not very great and their significance as a rule is unimportant.

**Benign Villous Papillomata** are like the benign fibrous form, solitary in occurrence, situated usually around the ureter, of highly variable size with tendency to growth of fimbriated instead of nodular surface and irregular instead of spherical form, sessile rather than pedunculated, complex rather than simply fibroid in constitution, highly vascular and usually hemorrhagic with distinct tendencies toward malignancy, multiplication and dissemination over the trigone, ureteric folds and posterior fundus; in other words, the floor as a whole. Usually they are discrete but may be massed and packed together into a cauliflower-like mass. If pedunculated the mass as a whole, like its villi, moves about in the fluid medium, but if sessile only the fimbriæ wave in and out the field. These villi make the mass look like a tuft of seaweed, may be long or short, few or many, delicate or coarse, vascular or pale and hence reddish-yellow or whitish in color. These papillomata are not "silent" but soon cause symptoms, especially hemorrhage, and should always be considered in the face of this symptom.

**Myoma and Fibroma** are not common and not usually important. They are sessile in attachment, infiltrating in extension and as elsewhere in the body involve respectively chiefly the muscular and fibrous tissue of the viscus. Commonly only the microscope will distinguish the diagnosis.

One of the earliest possible clinical developments of papilloma is shown by the case of O'Crowley<sup>1</sup> with the following history: The young man applied for examination as to venereal disease. General examination was negative but cystoscopy revealed the papilloma shown

<sup>1</sup> Personal communication to the author, May 4, 1917.

gs. 220 and 221. He had never had symptoms. The growth was covered with a little sparking.

**Papillary Carcinoma** is solitary, situated at almost any point, sessile or more than pedunculated, of rapidly increasing size, at first nodular,



FIG. 219.—Extensive villous tumor seen as a whole in one cystoscopic view but well displayed by inspection of right and left halves. (Marion, Heitz, and Germain.)



FIG. 220.—Papilloma in its earliest stage of development. Case of Dr. O'Crowley. (McCarthy.)

necrotic of surface, of highly lawless outline, always active in its symptoms which embody hemorrhagic and necrotic cystitis. The



FIG. 221.—Same as Fig. 220. Lens of cystoscope being in close apposition and showing the striking vascular supply. (McCarthy.)

forms require pathological diagnosis for exact decision. Infiltration of its annexa is always a prominent and diagnostic feature and may constitute a distinct variety.

<sup>1</sup> Loc. cit.

<sup>2</sup> Tr. Am. Urol. Assn., 1915, p. 64.

**Infiltrating Carcinoma** comprises the three types: epithelioma hyperplasia through degeneration of a simple ulcer, infiltrating hyperplasia by direct contiguity from uterine, prostatic and rectal carcinoma and exuberating hyperplasia as in the villous and papillary carcinoma. These three forms all have in common ulceration, proliferation into here and there, usually nodular, sometimes uniform infiltration, invasion, vascularity and edema.

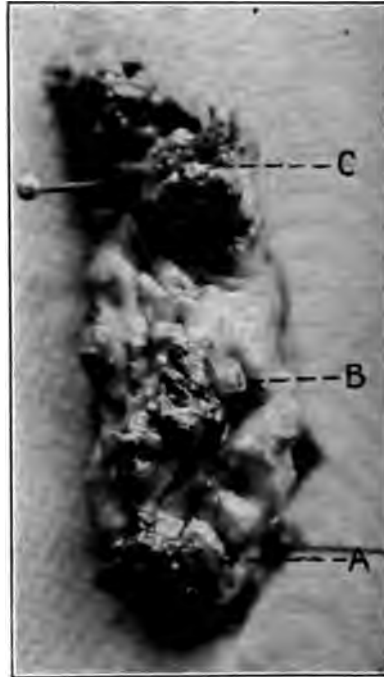


FIG. 222.—Multiple neoplasms of the bladder. Cancer of the bladder in three papillary outgrowths A, B, C, separated by normal mucosa, clinically speaking. The lower nodule was near the neck of the bladder in the retropubic quadrant on the right and the highest in the subperitoneal quadrant. The three were obliquely placed above downward and forward. The ureter was not involved. The rounded mass part (A) of the lower nodule was obviously infiltrated and on section showed the mass of the growth to be cancerous, as revealed in the photomicrograph. It had not begun to penetrate the muscular coat of the bladder. The middle growth (B) was found to be cancerous and the upper growth (C) was shown to persist as a papillary mass denuded of its epithelium by the high-frequency current of its applications. (Autopsy case.)

Cancer of the prostate, uterus and rectum frequently by direct extension into its annexa involves the bladder with an infiltrating hyperplasia showing little or no tendency to ulceration, necrosis, vascularity and edema. Thus while the bladder is materially bound down and involved, its general appearance except in form is not much changed. Or the mass of such a cancer presenting toward the bladder may be nodular and show all the usual signs of the disease. Inasmuch as

oms of cancer are at their acme at the original site rather than in infiltrating extensions, the foregoing are the expected facts in these instances of vesical cancer.

**ous and Colloid Carcinoma** are distinguishable from other forms with the microscope and are so rare as to be clinically unimportant. **oma** may be of the infiltrating and noninfiltrating type with rather than broken surfaces and of rather round and regular

Malignant tumors in early life are apt to be sarcomata while of later years, carcinomata, although sarcoma appears not monly as late as the fiftieth year of life. Sarcomata always give oms.



223.—Internal aspect of right and left halves of author's case of extensive na, primary in the subperitoneal quadrant of the bladder and occluding almost ire cavity. U., urethra; P., prostate; V.S., vesical sphincter; V.C., vesical Ur., ureter, greatly hypertrophied; S.C., surface of cancer necrosing; B.C., base r; V.D., vas deferens. It will be seen how extensive and infiltrating the mass growth is. There was no cavity left in which cystoscopy could possibly be ed, but the urethra was not occluded.

**ditional Neoplasms** are adenomata, myxomata, myomata and ata. They are not particularly important and have the same ions as the malignant forms so far as treatment is concerned.

**gnosis of Neoplasm by Cystoscopy** in general must determine at e following facts: the presence or absence, the site or sites with lar reference to the ureteric mouths, the number, the tendencies pecial respect for benignancy, malignancy, hemorrhage, infil-



tration, ulceration and necrosis and finally the relation of the neoplasm to its annexa and the ureters.

The presence or absence of a neoplasm of the bladder, the site or sites and the number of the growths are usually readily settled by a cystoscopy which reviews the bladder as a whole in the orderly manner set down in the paragraphs on regular plan of examination of the bladder on page 742.

Diagnosis of the tendencies of a tumor as to benignancy, malignancy, hemorrhage, infiltration, ulceration and necrosis is through cystoscopy often a difficult matter. A good rule is that when hemorrhage is present one should look upon the tumor with every possible means, such as direct vision, lateral vision, anterograde and posterograde cystoscopes and also the cystourethroscope when the growth is near the neck of the bladder.

The relation of the tumor to its annexa and the ureters is also of great moment inasmuch as the region of the ureters is one of the commonest sites of neoplasms and the effect of the neoplasm itself first on the ureter and second on the kidney is frequently an early sign of malignancy through congestion, compression, distortion, ulceration and infection which travels rapidly to the kidney.

A fragment of the tumor may be sheared off with the cold wire snare or cauterized away with the high-frequency current or cut out with the Buerger cystoscopic rongeur and sent to a pathologist. The following points of distinction in such an examination are important. The simple fibrous papillomata are very superficial and do not infiltrate at the immediate base or annexa. As soon, however, as malignancy appears, the infiltration begins as small nests in the deeper layers of the epithelium, or penetrating beyond the epithelium into the muscularis, or entering the bloodvessels, or underlying the thickening and edema around the base of the tumor or associated with more or less superficial necrosis.

Subjective history and symptoms in the diagnosis of vesical neoplasm are hardly ever typical or pathognomonic, so much so that the rules laid down in older text-books have been largely abandoned. The period of invasion of neoplasm of the bladder, namely, the earliest stage is almost invariably "silent" and symptomless and therefore misleading so that these growths are frequently discovered incidentally to cystoscopy for other purposes. Exceptionally, however, the new growth causes symptoms due to pressure and obstruction of the ureters giving a renal syndrome or the urethra setting up a vesical syndrome. The most suggestive, single, early symptom is hemorrhage, sudden, unexpected and idiopathic, intermittent with decreasing intervals of rest and finally remittent with increasing periods of copiousness invoking the secondary anemia of hemorrhage. Until the stage of constant hemorrhage with remissions appears most of the attacks are sudden and unprovoked.

The subjective symptoms of the establishment or extension of vesical tumor are much more though not finally pathognomonic than those of

the early stage and are never "silent"; predominant are pains, irritability of the bladder, signs of foreign body, cystitis, ulceration and necrosis with a secondary urine having the characteristic odor of rotten flesh. By the time even the pains and the irritability are present the golden moment for successful operation has passed. It is therefore justifiable to examine the bladder even when the suspicion of such trouble is only slight.

*Distinction between benign and malign vesical tumors* rests on the following broad principles: The majority of these neoplasms always become malign, although they may be at first benign. In general early age suggests benignancy excepting sarcoma in youth and malignancy in advanced life. Solitary papillary tumors are apt to be benign while multiple and increasing growths of this class are of the opposite tendency. Benign tumors have normal annexa while malign growths infiltrate, thicken and render them inelastic to distention of the bladder. Absence or moderation of vascularity almost invariably means a simple neoplasm while its presence if marked or increasing regularly suggests malignancy. The results of the neoplasm in the annexa are, as already stated, important so that malignancy usually means mechanical, vascular and inflammatory changes in the immediate surroundings so that we early expect to see distortion, pressure, obstruction, congestion, inflammation and infection of the ureter and pelvis of the kidney, while around the growth are vascularity, edema, thickening, inelasticity, infiltrations and fixation in implantation. Thus the bladder, the ureters and the kidneys may be profoundly and progressively affected by a malignant neoplasm.

In the diagnosis, moreover, the presence of superficial sloughs in the tumor, no matter how papillary it may seem, the infiltration of the bladder wall shown in changes in color, elasticity and surface, the presence of infiltration on bimanual examination, which should never be omitted, and changes in the dilatibility of the bladder under increase or decrease of the distending medium, are all important points in showing malignancy. The presence of carcinoma in neighboring organs such as the cervix uteri and prostate should also be known.

**Differential Diagnosis.**—Through the cystoscope lesions resembling vesical neoplasm may be studied. These vesical conditions are confused with the less defined forms of new growth.

*Chronic cystitis* with thickening and contracture of the bladder presents folds and rugæ which are thick, prominent, inelastic, shaggy, vascular and often ulcerated, but the long history and the more or less universal distribution of these lesions and of the chronic cystitis are usually sufficient for a decision.

*Vesical calculus*, especially if encysted or pocketed and only partially presenting instead of being free on the bladder floor coated with a thick scum of pus and blood and margined with edema and infiltrations, is sometimes difficult to distinguish. Palpation of the mass, however, with the ureteral catheter will usually settle the question, likewise a radiograph.

*Polypoid edema* and *cystic edema* about the neck of the bladder and the mouths of the ureters are distinguished from new growth in not being vascular and in being translucent, tense and smooth instead of opaque, dense and rugose.

*Organized adherent bloodclot*, especially in an ammoniacal cystitis coated with mucopus and phosphatic precipitates, may resemble a neoplasm but is distinguished from it if one irrigates the bladder thoroughly, touches the mass with the cystoscope or ureteral catheter or otherwise displaces it from its adhesion.

*Hypertrophy of the prostate*, especially of the middle lobe or of irregular type in one lateral lobe, is very difficult to be sure of as distinguished from neoplasm. A close vision cystoscope is usually advisable to note the absence of great change in the overlying mucous membrane, the identity of the mass as part of the prostate and prominence and protrusion into the bladder cavity rather than infiltration and fixation of the walls with vascularity, nodulation and ulcers.

*Extravesical neoplasm* is uterine, prostatic or rectal in its commonest sites. When it begins to affect the bladder it is usually by deformation and adhesion so that the mucosal changes within the bladder are much less in degree as a rule than intravesical cancer. Such changes when present are necessarily in the base of the bladder, including the trigonum. In such neoplasms the point of greatest activity is at the primary focus, in the uterus, prostate or rectum so that usually the bladder manifestations of the disease are those of the periphery of the growth with relatively milder symptoms and course.

**Treatment.**—Indications of operation determined by cystoscopy may be intravesical or extravesical in approach. The intravesical operations are performed through the cystoscope itself or through similar instruments. These procedures will be more minutely described later. They are naturally available for the benign neoplasms alone, such as pediculated, fibropapillomata, villous papillomata if small, and fibromata. The pedicles remaining should always be cauterized with the Oudin or d'Arsonval currents. Extraperitoneal cystotomy is applicable for tumors of the anterior wall corresponding with the prevesical space, while intraperitoneal cystotomy is reserved for neoplasms of the lateral and posterior walls and base.

*Hagner's<sup>1</sup> method* is valuable and ingenious. After preparation of the bladder cavity and exposure of the viscus through the abdominal wound, a cystoscope is inserted and the neoplasm brought into the field, especially around the base. Pressure with the needle in a holder is made through the abdominal wound until a point is reached beyond the infiltration determined by the cystoscopic picture of the dimpling in the bladder made by the needle. When a suitable point is reached the needle is passed widely through the bladder wall and the suture employed as a traction suture. Two or more such sutures are employed

<sup>1</sup> Tr. Am. Assn. Gen.-urin. Surg., 1911, vi, 128.



to outline the base of the tumor for the excision and to secure the bladder wall for the repair suture later.

Total removal of the bladder after transplantation of the ureters into the loin, according to the method of Watson,<sup>1</sup> may be tried in extreme cases.

Drainage of the bladder after operation by the indwelling catheter is easy in the female but difficult in the male. The catheter may be held in place by a stitch passed through the meatus urinarius, as suggested by O'Neill.

*Squier's Operation.*—The most modern operative technic for the radical extirpation of vesical neoplasms has been developed by Squier.<sup>2</sup> The growth is removed *en masse* with a wide encircling margin of healthy tissue, and since it is a matter of record that a functioning bladder has been regenerated where only the trigone has remained after an extensive excision, it is apparent that it is only necessary to conserve the three natural orifices of the bladder, the ureteral orifices and the internal meatus. Considering this anatomic trinity, the technic about to be outlined exposes the bladder in its entirety, and renders it possible to free the posterior and fundal attachments as far as the trigone, without an unusual degree of hemorrhage or traumatism. *Seriatim*, the steps are as follows:

*First Step. Skin Incision.*—From one inch above the umbilicus on the left side, downward to two inches above the symphysis in median line.

The sheath of the rectus is divided along the whole length of the skin incision and the peritoneal cavity opened. The patient is then placed in the extreme Trendelenburg position and the intestines gently deposited in the upper portion of the abdominal cavity. After this the pelvic cavity is thoroughly walled off by gauze rolls.

*Second Step. Exposure of the Prevesical Space.*—Lengthen the abdominal incision downward through skin and fascia and divide the pyramidalis muscles at the symphysis, exposing the prevesical space.

*Third Step. Exposure of the Hypogastrics.*—The peritoneum and urachus are grasped with a Barrett's intestinal forceps at the lower angle of the peritoneal incision. Upon traction being made upward, the obliterated hypogastric arteries are brought prominently into view extending laterally as two diverging cords.

*Fourth Step. Exposure of the Vas Deferens.*—The left obliterated hypogastric artery is grasped with a forceps and traction made upward and to the right. By blunt dissection between the obliterated hypogastric artery and lateral wall of the pelvis, the left vas deferens is recognized and brought into view as it courses along the pelvic wall to the inner side of the obliterated hypogastric artery.

*Fifth Step. Exposure of the Ureters.*—By gentle traction the left vas deferens is made taut and by means of blunt dissection downward along its course the pelvic ureter is uncovered as it bends inward above

<sup>1</sup> Ann. Surg., 1905, xlii, p. 805.

<sup>2</sup> Squier and Heyd: Surg., Gynec. and Obst., July, 1914, p. 91.

the fascia of the pelvic floor to enter the bladder. The ureter at this point is crossed on its inner side by the vas deferens. A similar exposure is made on the opposite side and the right ureter exposed.

*Sixth Step. Final Separation of Peritoneum from the Bladder.*—The urachus is divided close to the bladder and from the two points of lateral dissection the peritoneum is stripped off the fundal surface of the bladder. The denudation extends deep into the rectovesical space and the peritoneal cul-de-sac of Douglas is pushed upward and backward. At this point traction on the bladder downward toward the symphysis exposes the superior poles of the seminal vesicles. The result of the completed denudation is that the whole fundus of the bladder and the upper portion of the posterior surface of the trigone are exposed; the ureters are constantly in sight and the anterior or pubovesical attachments of the bladder have been left undisturbed. No hemorrhage of any moment has been encountered and the venous ooze has been easily controlled by hot wet pads.

*Seventh Step. Protection of the Peritoneal Cavity.*—The denuded lamella of the peritoneum is carefully carried to the upper end of the abdominal incision so that all subsequent procedures are extra-peritoneal.

*Eighth Step. Exposure of Bladder Neoplasms.*—The bladder is grasped high up on the posterior surface and an incision is made in the longitudinal direction, about one inch in length. Through this opening an inspection of the bladder is made and the topography of the tumor determined. The incision is extended in any direction that may be necessary for proper operative exposure. Since, in the majority of instances, the tumor will be found to occupy either the summit, side, or trigone of the bladder, an incision downward in the posterior median line, which splits the organ in half, will be the usual incision of election.

*Ninth Step. Extirpation of Neoplasm.*—The neoplasm is excised *en masse*, together with a wide margin of healthy, uninvaded tissue comprising the entire thickness of the bladder wall. The exposure of the ureter which has already been made now becomes of prime importance. If the ureter is affected it is divided between ligatures above the growth and the distal portion is removed with the tumor. The proximal portion is allowed to remain undisturbed until partial closure of the bladder defect is accomplished.

*Tenth Step. Closure of Bladder Defect with Implantation of Ureter.*—The hiatus of the bladder wall after incision of the tumor is partially repaired as illustrated, the method of closure being similar to the Connell intestinal suture with No. 2 chromic catgut. A stab-wound is made through the bladder wall at a point approximating the normal ureteral opening and the proximal portion of the divided ureter drawn through this opening by a thin dressing forceps.

*Eleventh Step. Anchoring the Ureter to the Bladder Mucosa.*—The ureter is brought through the stab wound and anchored to the bladder wall. About one-half to three-fourths of an inch of the ureter is allowed to protrude into the bladder. Two flaps are made by bisection of the

teral stump and the flaps turned back and anchored *in situ*. The remaining defect in the bladder is now sutured as above and drainage of the bladder instituted by means of a stab, button-hole incision, anterior to the line of incision and at a point which will correspond to the highest point of the bladder when the operation is completed. Through this aperture a No. 26 F. soft-rubber catheter is drawn and

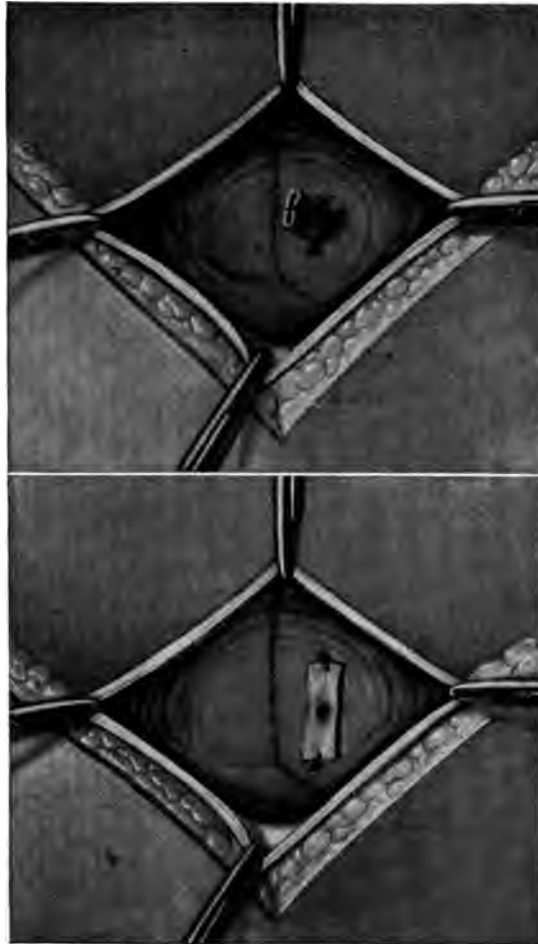


FIG. 224.—Implantation of divided ureter after partial closure of bladder defect. (Squier and Heyd.)

tured *in situ*. A drainage tube inserted in this manner insures against leakage along the tube into the prevesical space.

*Twelfth Step. Closure of Abdominal Wound.*—The final step is the position of the peritoneum over the vesical suture line and an accurate closure of the peritoneum. If the peritoneum is invaded by the growth, the involved portion is resected with the growth and the peritoneal



hiatus closed after the usual fashion, particular care being taken to prevent a peritoneal suture line being superimposed upon a bladder suture line. A cigarette drain is inserted into each lateral space leading down to ureter and the abdomen closed with figure-of-eight silk wound sutures. In addition, a self-retention catheter is inserted.

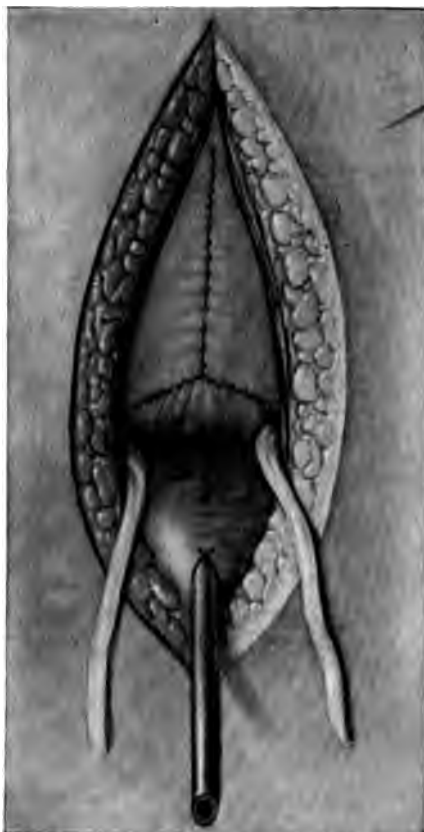


FIG. 225.—Accurate closure of peritoneal cavity, showing the two cigarette drains and separate stab-wound for drainage of bladder. (Squier and Heyd.)

Among the advantages of this method of technic may be mentioned:

1. By primary denudation of the peritoneum a free access to the posterior surface of the bladder and trigone is obtained.
2. The removal of the tumor is a *removal en masse*. If necessary, the lymphatic glands along the lateral walls of the pelvis and iliac vessels may be removed.
3. The counterstab button-hole drainage at the highest point of the bladder is a decided improvement in technic.
4. The noninterference with the pubovesical attachment is a distinct advantage and makes for rapidity of convalescence.

reposition of the peritoneum minimizes the leakage and primary union.

ureters are constantly in sight and their exposure allows a multitude of operative procedures.

*m Treatment.*—The x-ray in the treatment of cancer of the bladder is not a success exactly as in the treatment of cancer of other membranes even when superficial instead of deep in a viscus bladder. The crossfire intensive x-ray treatment postoperatively prove of greater value.



3.—Ablation of vesical neoplasms with the cautery. Removing tumor of wall of the bladder with the cautery preliminary to application of spark.

iger<sup>2</sup> has evolved the following technic in cancer of the bladder, using the element through the cystoscope and turning the patient on his side for contact between the radium and the lesion and maintaining the contact for many hours for penetrating effect. It is to be remembered that the energy of radium obeys the law of all physical bodies, that it varies inversely as the square of the distance. A specimen of energy is 1 will have fractions of this force as the distance from it of application increases. Whether this physical fact is of importance remains to be seen by time and experience. The details of Barringer's method are as follow:

From 100 to 200 millicuries of radium screened with 0.6 mm. of lead and 1.5 mm. of rubber are put up so as to form a capsule about

<sup>1</sup> Tr. Am. Urol. Assn., 1915, ix, 118.

<sup>2</sup> Jour. Am. Med. Assn., November 11, 1916, lxxvii, 1442.

1 inch long and one-eighth inch in diameter; to this is attached a long, stout, double linen thread. A direct cystoscope is introduced into the bladder, the capsule put through its sheath and the cystoscope withdrawn, leaving the radium in the bladder. The linen thread attached to the tube runs through the urethra and appears at the meatus. In women one may reintroduce a small cystoscope and see if the radium lies on the tumor. The patient remains in bed during the application. This, perhaps, is a crude and inaccurate way of applying the radium. On the other hand, a large majority of bladder carcinomas are in the base, and the tube of radium cannot be very far from a carcinoma in this position; certainly much nearer than a rectal or suprapubic tube would be. If the carcinoma is located on one side of the bladder, the patient is told to turn slightly toward that side while the radium is applied. The patients generally have been able to urinate without trouble during the application. Some have held their urine until the end of the irradiation, at most eight hours, and then urinated or were catheterized after the radium was removed. The urine possibly to some extent screens the vault of the bladder (all of my patients to date have had carcinoma of the base) and also lifts the bladder mucous membrane of the vault away from the radium. Whatever may be the reason, the normal bladder mucous membrane seems very resistant to radium burns when the radium is used in this way."

#### LITHIASIS OF THE BLADDER.

**General Considerations.**—A technical work on cystoscopy must omit discussion of the clinical features of the process of lithiasis of the bladder and concern itself only with the recognition of the fact of absence or presence of the stone. Given therefore the syndrome suggesting a stone in the bladder, the cystoscopist concerns himself with the actual examination for it.

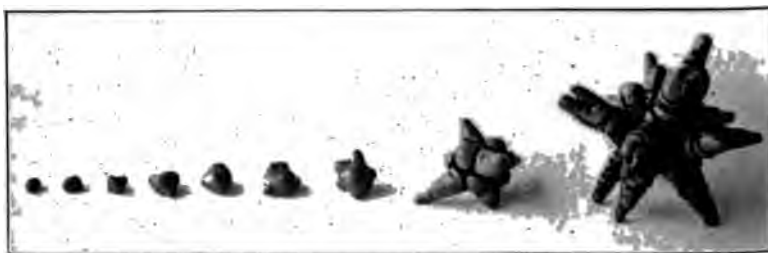
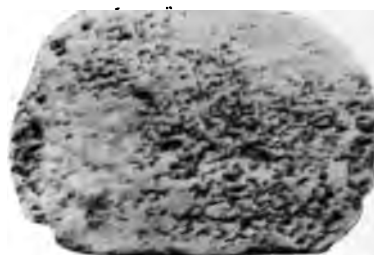


FIG. 227.—"Jackstone" calculi, nine in number, removed from the bladder of a man, aged eighty-four years. (Case of Dr. C. Rutherford O'Crowley.)

The cystoscopist is required to decide the occurrence of the stone, whether single or multiple; the size, large, small or mere gravel; the location, vesical, ureteral, ureterovesical, diverticular or vesico-diverticular; the mobility, free on the bladder floor or immobility,

## PLATE XII



### Lithiasis of the Bladder. (Pousson and Carles.<sup>1</sup>)

(Reading from left to right).

Urate sand.  
Fine urate gravel.  
Urate granules.  
Granular uric acid stone.

Oxalate sand.  
Coarse oxalate gravel.  
Oxalate granules.  
Rough phosphatic stone.

<sup>1</sup>*Encyclopédie Française d'Urologie*, 1914.



hed to the bladder wall, or contained within a ureter, diverticulum or deep trabeculation; the origin, renal, ureteral or vesical, by



228.—Multiple vesical and urethral calculi. The stones were twenty-five in number, of which twenty-three were in the urethra and two in the bladder, removed by external urethrotomy. Calcium oxalate and uric acid were the composition. (Wiley.)



229.—Author's case of lithiasis of bladder and posterior urethra, secondary to ectomy. The diagram of the bladder and urethra, with the notes, makes the clear.



formation or migration, the cause, located in kidney, ureter or bladder by local disease, deformity or anatomical abnormality; and finally the treatment, viz., litholapaxy, suprapubic cystotomy, Chismore evacuation or fragmentation with high-frequency current.

**Cystoscopy.**—Cystoscopy rests on the foregoing principles and is ordinarily standard in its details except in bladders showing intolerance, contracture and deformity. Any and all these conditions limit the degree of distensibility, the amount of medium available and frequently prevent examination. In the foregoing pages on cystitis, the methods of overcoming them are sufficiently described. If all efforts fail the radiograph is the last resort, and is frequently valuable to settle a doubtful diagnosis and should, therefore, never be omitted in such circumstances.



FIG. 230.—Lithiasis of the bladder. Compound stone in the bladder of a sixteen-year-old Italian, located in the diverticulum. Lithotripsy; complete recovery of bladder; normal kidneys and ureters. (Author's case.)

The preparation of the bladder containing calculi implies irrigation to cleanliness except in contraindications. Full evacuation of the bladder tends to increase irritability, while semievacuation leaves a cushion of fluid behind which prevents the stone from damaging the mucous membrane at flux of the fluid.

Insertion of the cystoscope should be very gentle and preferably during partial distention only. This tends to increase the likelihood of having the instrument pass gently over the stone, which is an important corroborative incident. When the cystoscope is easily in place, the distention is brought to the limit.

The illumination is now turned on and exploration begun, giving most attention to the posterior hemisphere of the bladder, which, in the lithotomy position, is inferior. Free stones gravitate into it and lie, most commonly above the ureters in the subperitoneal quadrant, less commonly in the ureterotrigonal quadrant, which, in women, may have a pouch obliterated; in men, by the rounded prominence of the prostate, so that in them the majority of stones are in the superior posterior quadrant, whereas in women the uterus reverses the situa-

tion in many cases. Fixed stones, however, may be located anywhere in the bladder, and therefore a careful cystoscopy requires going over the entire viscus.

The presence of single and multiple stones and of large and small stones is relatively easy except that gravel cannot ordinarily be counted.

The size of a vesical calculus is rather readily estimated by counting the number of cystoscopic fields required to cover it in its largest diameters at right angles to each other. The focus must be maintained carefully, and the transition from field to field carefully taken by noting definite opposite points in the margins. The distance between the ureters is known to be about 4 cm., which is a convenient measure often in the same process.

The localization and the condition of the stones are very important.

Free and movable may be distinguished from fixed and immobile stones by palpation with the beak of the cystoscope, ureteral catheter, with or without stilette, the operation forceps and changes in the position of the patient from, for example, the exaggerated lithotomy to the sitting position.



FIG. 231.—Four stones due to urethral obstruction and intense cystitis about eight weeks after prostatectomy. (Author's case <sup>1</sup>)

Mobility and fixity of ureteral stones are, moreover, of moment because such stones act reflexly on the kidneys as obstructions and excite congestion and later infection, as has been abundantly proved by animal experimentation. It, therefore, follows that all ureteral stones whether they present at the outlet of the ureters or not should be very carefully investigated.

Immobile stones are either attached to the bladder wall, encysted in anatomical abnormalities, or retained in the ureters. Attachment of vesical calculi occurs to the surfaces of ulcers, stitches in the bladder wall, foreign bodies and neoplasms usually in the form of incrustations. Encysted and retained stones occur in diverticula, ureters and trabeculae of old prostatic bladders. They may be of any form, most important

<sup>1</sup> Prostatic Suggestions, New York Med. Jour., July 29, 1911.

of hour-glass shape so that part is within the bladder and part out. If the neck is broken the latter may remain undetected. The mob of stones within the ureters is important because frequently they be removed without a cutting operation provided instruments may be passed beyond them as later described.



FIG. 232



FIG. 233

FIGS. 232 and 233.—Multiple shotlike calculi in a diabetic. The left field shows stones dropping from the left ureter toward the enlarged prostate below. The right field shows the right ureter with many of the calculi clinging to the bladder wall (Author's case.)

It is important to study the bladder after the movement of a free or attached stone by itself, palpation, removal or crushing. The rule

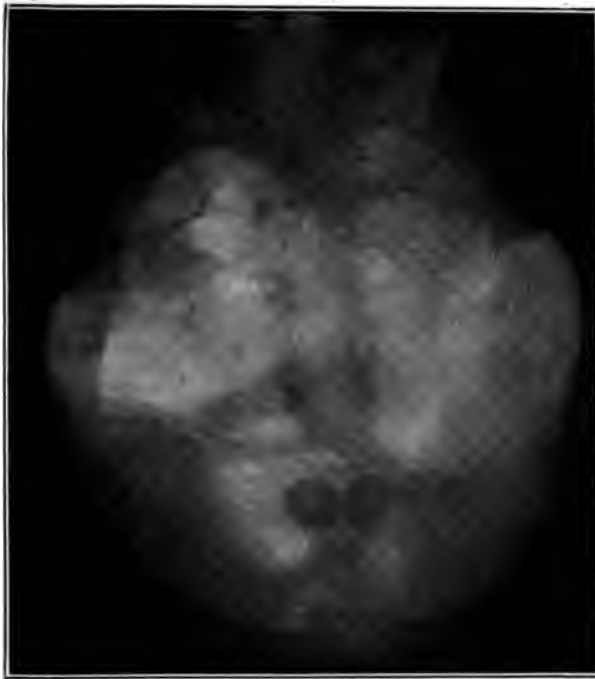


FIG. 234.—Very large mulberry calculus removed from bladder during prostatectomy (Author's case.)

applies in endovesical and open operations, otherwise conditions in the bladder wall will go unrecognized, such as ulcers, early neoplasm and foreign conditions like stitches. Treatment of such underlying conditions is essential and its reasons obvious.

<sup>1</sup> Loc. cit.

origin of stones in the bladder is either formative, due to local processes, or migratory from the upper urinary tract due to pathology and then to transit into the bladder, or both migratory and formative combined, due to the growth through disease of the wall of a stone formed in the ureter or the kidney first. Formative stones or augmentations to renal and ureteral stones are due to position of urine in the bladder. Such calcareous deposits may occur on any foreign body such as masses of mucus, hair, hairpins, and the like. The process of decomposition and precipitation of urine is favored by the existence of pockets, deformities and inflammation in the bladder.



35.—Three stones side by side, practically in the line connecting the two ischia and close to the shadow of the coccyx, in a sixteen-year-old boy. (See case.)

The common kinds of stone in the bladder should be familiar to the urologist and easy of recognition by him, namely: phosphatic, uric acid and oxalate stones.

The common features of these three kinds are as follows:

Phosphatic stones are most common in alkaline urine, less so in acid urine unless blood stained, usually of roundish shape but not uniformly flaky, single or multiple, large or small, soft and friable, but less so than oxalate stones, accompanied by many crystals in the urine and commonly ascribed to vesical origin. Some phosphatic

stones are migratory from the kidneys or ureters where changes in metabolism of the urine precipitate the salts usually in solution.

Uric acid calculi occur in acid urine often accompanied by uric acid and urate crystals and are brown with reddish or yellowish tone largely in proportion with the amount of illumination, single or multiple, large or small, frequently faceted because multiple, hard rather than soft, ovoid, rough and irritating to the bladder and quite frequently are the nuclei of phosphatic deposits upon them. Their origin is usually renal, especially in those cases where a secondary enlargement of phosphates is found.

Oxalate of lime stones are also found in acid urine, proceed from the kidneys as a rule, are brown in color or blackish, being considerably darker than the uric acid deposits, are rough, rarely smooth, constituting the so-called mulberry calculus. The urine contains many oxalate crystals.

Cystin stones are rare and are commonly found in acid urine.



FIG. 236.—Fragments of calculi after incomplete lithotripsy. The smaller fragments should have been pumped out through a Chismore instrument, leaving the larger pieces to be crushed at a later sitting. The bladder wall is excoriated from the rough fragments and covered with shreds of mucopus. (Marion, Heitz-Boyer, Germain.)

**Diagnosis.**—The origin of stones in the bladder by cystoscopy should distinguish renal, ureteral and vesical deposits. Calculi from the upper urinary tract, the kidney and the ureter are in a certain sense synonymous in origin and may be distinguished usually by the x-ray photograph which should always be added to the cystoscopy if there is any doubt whatever.

The following data are usually sufficient to make the distinction of the source of stones seen in the bladder.

As to number, size and form of the stones, it is recognized that these are not final in the decision. However, as a rule, renal stones tend toward increased number, smaller size even to that of seeds and gravel, perhaps 1 mm. in diameter. The less the number the larger the size, as a rule, and the more ovoid the form up to 1 or 2 cm. in diameter. Vesical calculi, on the other hand, are less numerous, frequently solitary, larger, spheroid rather than ovoid in form or irregular and faceted.

<sup>1</sup> Loc. cit.

They may be very large even to the exclusion of cystoscopy. Deposits of foreign bodies are always of vesical origin.

The relation of stones to each other leading to changes in form and size points to vesical origin.

The condition of the urine is important in this diagnosis. Acid urine with crystals of uric acid and urates usually means renal origin of the larger calculi. Alkaline urine, on the other hand, with phosphates suggests vesical source.

The state of the bladder is another interesting detail. Manifest cystitis, deformity, abnormality, trabeculation and pocketing of the bladder all prove vesical formation of the deposit.

The color of the stones is in the absence of blood and dyestuffs of no moment. The white stones are phosphatic and vesical while the brownish, blackish and yellowish stones are more apt to be uric acid and renal.

**Treatment and Management.**—Free and movable stones should be fragmented either by crushing or the high-frequency Oudin current and then, like small individual stones, removed with the Chismore extractor. Surapubic and the now nearly obsolete perineal cystotomy is justifiable less and less frequently.

The indication is, therefore, to render all fixed stones movable and then to proceed with them on the foregoing recommendations. Attachments may be loosened with the cystoscope itself, ureteral dilators with or without stilettes, or the Buerger cystoscopic operating forceps and ureteral bougie-à-boule. Ureteral stones should be dislodged and delivered from the ureters by dilation up to their site and by injection of sterilized olive oil above, around and below them through a ureteral catheter.

Open operations are justified when the stones are too large or too fixed to crush or too fixed to dislodge, and when changes in the bladder wall in cystitis and contracture show that long-continued drainage will be helpful.

*Postoperative treatment* should never be neglected. Ulcers and growths arising from attachment to deposits, deformities of the bladder due to obstructive and uterine conditions, and in general cystitis all demand individual appropriate treatment. No patient having had a stone removed from the bladder or ureter should be discharged without a period of observation, punctuated with regular cystoscopies.

*Sources of error in cystoscopic diagnosis* are three: blood clots, plugs of mucus and flaky precipitates and sometimes the universal change in color of the bladder wall and contents through the previous administration of methylene blue, for example. The distinction is reached through irrigation especially with the cystoscope in place and the object under the eye, through displacement of it with various instruments in the operating cystoscope, and particularly with the high-frequency current. Flaky precipitates are really calculi with no definite form; their great friability and irregular more or less distribution reveal their nature. With patience and care no mistakes from these sources should occur.



*Stone Searchers.*—The type of Posner has been abandoned in favor of that of Thompson, which has the limitation of not irrigating the bladder at the time the instrument is passed. As an improvement on the Thompson instrument the author<sup>1</sup> devised the instrument shown in Fig. 237 and having the following features: "Its curve is on the radius of that of the standard sound, shortened by one inch and flattened from

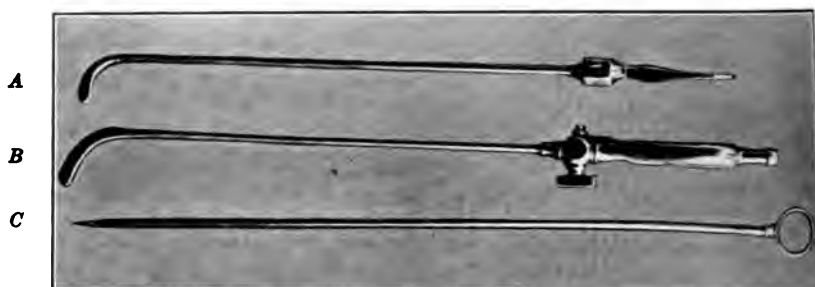


FIG. 237.—(A) modern model of Thompson's stone searcher; (B) author's irrigating stone searcher, showing connection tip of silver catheter, stop-cock and shaft; (C) obturator of the catheter.

side to side throughout its length from extremity to shaft. Its extreme width will pass through 21 French, and is reduced only from 7 to 6½ mm. where it joins the shaft. The diagram shows this well in the end view and side-view of the instrument. The shaft with the curve is 9½ inches long, and duplicates the Posner instrument, with these exceptions: (a) There is no rider for the scale of centimeter graduations. (b) Most important of all, a 10 French silver catheter passes from the base of the curve to the hose-connection in the handle in one straight line, thus giving to the instrument all of the advantages of the same



FIG. 238.—Cystoscope, rongeur with small calculus in its jaws, withdrawn as one instrument. (Author's case.<sup>2</sup>)

plan laid down for the writer's 'Irrigating Sound of the Standard and Béniqué Type,' described in the *Annals of Surgery*, for October, 1909. The obturator of the stone searcher is a full-size brass wire, which passes through to the opening of the catheter at the base of the curve (see

<sup>1</sup> V. C. Pedersen: *Med. Rec.*, February 19, 1910.

<sup>2</sup> *Loc. cit.*

C of Fig. 237). At this point it is convexed, while the catheter is concaved, in order to correct any sharp edges or corners.

"The tube-connection (*B*) receives  $\frac{3}{8}$  inch diameter rubber tubing and seats the obturator in a modified bayonet-catch. The slot of this catch and the plug (*A*) of the obturator setting into the slot are so arranged that the sharp oblique point of the obturator cannot possibly be exposed as *M* through the tube. This detail adds safety in the use of the instrument.

"The advantages for this instrument are: that it may be used either for an irrigating or nonirrigating searcher, that its flat beak permits diagnosis of small stones with greater certainty, that its straight, large tube permits of rapid and full irrigation of the bladder when required, and also much more adequate cleansing and asepsis of the instrument."

### FOREIGN BODIES IN THE BLADDER.

A large variety of foreign bodies occur in the bladder through accident, criminal intent and sexual perversion. The cystoscope is the best means of diagnosis in the midst of symptoms which closely simulate those of stone. Such bodies rapidly become incrustated with salts of lime or other urinary constituent and are thereafter truly vesical concretions. Fig. 241 shows a piece of irrigation nozzle broken by a colleague while irrigating a bladder through the cystoscope previously reported by the author as cited. A piece of catheter had previously



FIG. 239.—Foreign body in the bladder. Hairpin, incrustated with phosphatic salts and embedded in a point of bullous edema of the wall as part of active cystitis. Marion, Heitz-Boyer, Germain.<sup>1</sup>)

been broken off in a bladder by a nurse but was recovered by Dr. Jouley by means of a lithotrite in 1893, practically before the days of modern cystoscopy, and illustrating the skill possible with such instruments. Fig. 239 shows a hairpin introduced into the bladder by a woman probably during sexual perversion and lost. The thick coating of phosphates illustrates the course of such foreign substances in the urinary system.

<sup>1</sup> Cystoscopie d'Exploration, 1914.



FIG. 240.—Chewing gum removed from the male bladder. Seven fragments are shown about full size. Five were removed with the Chismore lithotrite and two with the Chismore pump. Incrustations of urinary sediment are visible on at least three of the large fragments. Tooth-marks of the lithotrite are reasonably clear on the largest piece. (Author's case.)

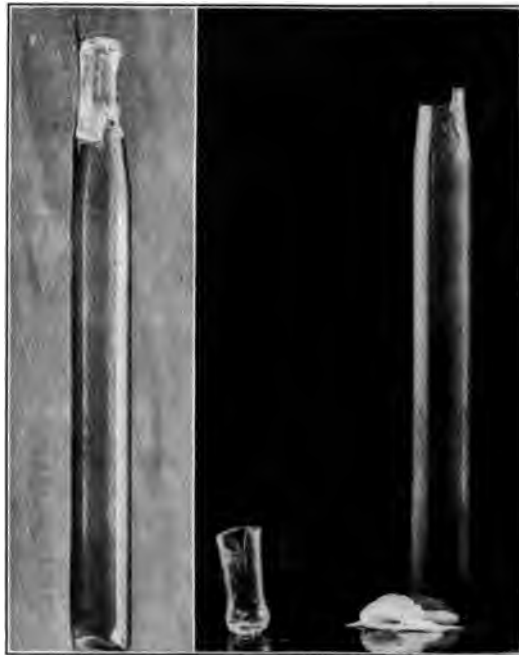
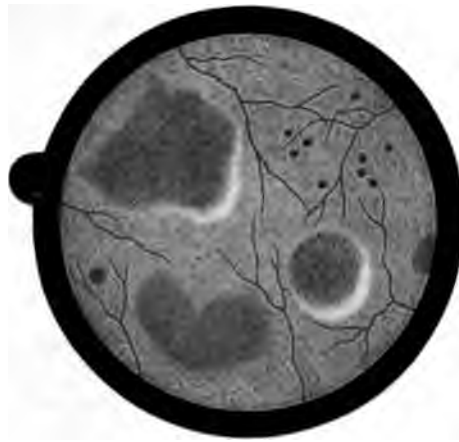


FIG. 241.—Glass fragment of irrigating nozzle extracted from bladder.

PLATE XIII



**Purpura Hemorrhagica of the Bladder. (Bruni.<sup>1</sup>)**

**Diffuse lesions, both new and old, with a few very small punctate examples.**

<sup>1</sup>Marion, Heitz-Boyer, Germain: Cystoscopie d'Exploration, 1914.

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## RARE FORMS OF DISEASE OF THE BLADDER.

**Classification.**—The usual types of disease of the bladder are difficult of classification except in the most general way as: anatomical, circulatory, inflammatory, parasitic and traumatic. A brief discussion of each is possible in a work like this.

**Anatomical Rare Forms.**—Anatomical rare forms concern rather the extremes of the conditions commonly met in bladders showing trabeculations, pouches and diverticula, all and severally due more or less to obstruction as in prostatics, or to atony of the bladder as in advanced age in both sexes, or to paresis or paralysis of the bladder as in organic spinal disease most especially posterior spinal sclerosis. Associated lesions are almost invariably great distention and chronic cystitis. Many of these anatomical conditions are of progressive occurrence as real sequels of cystitis, obstruction and paralysis.



FIG. 242.—Varix in the trigonum. The large vessel is shown but none of the small fibrillations. (Knorr.)

**Circulatory Rare Forms.**—Circulatory rare forms are summed up in varicosities more marked in degree and more persistent in course than those seen during acute or subacute conditions. Examples of acute and subacute varicosities proceed from obstruction of the urethra as in abscess of the prostate and are really an ascent from congestion. More chronic varicosities occur in disease of the heart, kidneys and liver and in pregnancy, all due to mechanical obstruction commonly at points distant from the bladder. The failing circulation of old age is another factor. Varicosities show themselves as groups of dilated veins usually in association with the affecting organ such as the prostate.

**Purpura Hemorrhagica.**—Purpura hemorrhagica of the bladder is a rather rare but important condition associated with purpura and having the following characteristics: The urine is full of clotted and fluid

<sup>1</sup> Loc. cit.



blood fully mixed with the urine, appearing in attacks and in association with more or less pain during the actual bleeding. X-ray examination is necessarily negative. Cystoscopic findings show healthy ureters, the mucous membrane normal and pale if the bleeding has been great, but showing irregularly disposed, formed and sized typical purpuric patches. The tendency is for them to be most numerous in the lower and upper posterior segments. Ulceration is absent. Systematic cystoscopic examination of patients with purpura, showing hematuria, will probably bring to light a really large number of these cases.



FIG. 243.—Small diverticulum of the bladder. The zebra catheter passes into the kidney while the bismuth catheter delivered the argyrol into the diverticulum. (Author's case.)

**Inflammatory Rare Forms.**—Inflammatory rare forms are exemplified by the leukoplakia vesicæ of Knorr which is cognate with leukoplakia linguae and like it is the product of chronic infiltrating inflammation of the mucous membrane. It consists of hypertrophy of the epithelium in plates with sharp borders closely attached to the underlying structures. The exact cause is unknown excepting that it occurs during or after chronic cystitis and is at times idiopathic. Its symptoms are those of chronic cystitis, namely, dysuria, pollakiuria, pyuria and hematuria.

**Parasitic Diseases.**—Parasitic diseases of the bladder consist of *echinococcus* and *distoma hematobium* (Bilharz). The author<sup>1</sup>



4.—Small diverticulum of the bladder. The bismuth catheter has turned upon itself and is presenting at the ureteric orifice. (Author's case.)



5.—Left ureter filled partially with collargol. Bladder filled with collargol. Friction between the two shadows represents the diverticular orifice. (Young.)

<sup>1</sup> V. C. Pedersen: New York Med. Jour., May 3, 1913.

has pointed out elsewhere that urinalysis will reveal the daughter cysts and the hooklets of echinococcus and also the ova of bilharziosis. This fact is sufficient for dismissal of echinococcus, but there is more importance to be attached to consideration of bilharziosis which is due to infection in the tropics with the *distoma hematobium* (Bilharz). The disease is endemic in Egypt and Cape Colony and is assuming more and more importance as the number of tourists and hunters in Africa increases. E. Hurry Fenwick, for example, states that subsequent to the campaigns in Egypt and South Africa the disease has become not uncommon in England. The following description is adopted from his quotation from Griesinger's work.<sup>1</sup> It is a disease of the vesical, ureteral and renal mucosa and not of the muscularis. It may be classified into early mild cases, later severe cases, both of inflammatory type, severer cases of vegetating type and chronic cases of pigmented type.

The early mild cases are usually localized, occasionally disseminated chiefly over the posterior wall of the bladder in hyperemic spots varying up to 2 cm. in diameter, with defined or congested borders, extravasation, edema, coatings of thick mucus or sanguineous exudate frequently containing ova and having ulcers beneath. Generalized infection of the bladder cavity is rare and then has marked inflammation with frequent ecchymosis. Ulceration of distinct type in this degree is rare.

The later more severe cases take on the productive inflammatory form and show elevations of grayish-yellow, yellow, dull white or otherwise pigmented color, coatings, leather-like in consistency, smooth apparently below the surface, having a precipitate non-adherent and consisting of urinary salts, ova and shells of ova, all incorporated with the epithelial covering which comes away with it. Other patches are soft, pliable and hemorrhagic. Pigmented patches of dirty, red, gray, or black color in the midst of mucosa otherwise normal excepting for new and progressing deposits are also seen in these cases. In this stage ulcerations of the character beneath the coatings may occur but are rare. The distoma is found in the neighborhood of the bloodvessels in little sacks connecting with them and the eggs are usually in the infiltrated submucosa from which they rupture into the bladder with bleeding when the bladder closes upon itself at the end of urination. From this it follows that the terminal bleeding, if any, contains the ova.

The severer vegetating type resembles the foregoing excepting in the fact that the productive element of the inflammation is exaggerated so that all varieties of elevations occur from flat and sessile to elevated and prominent, single and multiple, pea to bean size, yellowish or ecchymotic, often raised, warty and fungoid with restricted basis, like condylomata acuminata. Often the mucosa over them is normal but more usually thick and adherent. They may be injected, dark red with submucous edema or soft yellow brown and brittle or firm and infiltrated with coagulated blood.

<sup>1</sup> A Handbook of Clinical Electric-light Cystoscopy, by E. Hurry Fenwick, F.R.C.S., 1904, pp. 530 to 534, inclusive.

vascularis is unchanged except along the lines of hypertrophy of the cystitis. The distoma rarely invades it.

The peritoneal coat of the bladder also escapes, although one case is reported showing pigmentations and thickenings.

Dr. Bentley found the distoma in the submucosa of the vegetations in the bladder wall, cyst-like pockets having connections with the blood-

submucosa of the ureters and pelvis of the ureters show similar changes.

In the ureters are found irregular islands, yellowish, slightly elevated, with soft, adherent sandy coating and containing ova and debris on the walls. Their important sequels are stricture, dilatation, and atrophy of the ureter and congestion of the kidney.



FIG. 246



FIG. 247

Fig. 246.—Pelvic abscess ruptured into the bladder. The pelvic abscess was of the sigmoid, situated on the left side of the patient, ruptured into the bladder, causing cystitis and simulated diverticulum. Cured by operation by Dr. J. Bentley as stated in Fig. 247. (Case of Dr. N. P. Rathbun.)

Fig. 247.—Pelvic abscess ruptured into the bladder. This is the same case as that in Fig. 246. At operation the abscess appeared to come from the acetabulum. The shadow has not been corrected so that the shadow appeared to be on the patient's left. Kidney, ureters and bladder negative to x-ray. (Case of Dr. J. Bentley)

The frequency of travel, exploration and hunting expeditions in the Cape Colony makes this disease more and more important in the temperate zones. Anyone returning from such expeditions with the symptoms of penile pain, irritability of the bladder, and cystitis should be suspected of having the disease. And drops of his blood should be examined for the ova of the distoma.

The prognosis of the disease may largely be estimated by the degree in terms of the severity of the process as previously mentioned. Bits of vegetation and other deposits may be removed for examination with the forceps of Buerger.

This report presented at the meeting of the New York Society of the Am. Urol. Assn., Dec. 1917, and previously unpublished.



**Traumatic Rare Forms.**—Traumatic rare forms are summed up as results of injury, operation and pressure necrosis resulting most commonly in fistula and less usually in simple scar tissue. Subsequent healing of the fistula and contracture of the scar often lead to deformity of the bladder. Diagnosis in such deformity rests on the objective examination of the bladder with the cystoscope and carefully taken history. Common sites of such lesions are between the bladder and the abdominal wall after suprapubic cystotomy, between the bladder and the perineum after perineal cystotomy, between the bladder and the vagina or the uterus after the accidents of childbirth and occasional operations and finally between the bladder and intestines. Very rarely such pathological conditions as dermoid cysts may rupture into the bladder and their abnormal contents appear there as the nuclei of calculi. For example, E. Hurry Fenwick reports a case in which tubal pregnancy with a dead fetus of supposedly years' duration resulted in a fistula between the sac and the bladder and the sac and intestine. The writer has had a case of fistula after a prostatic abscess operation with a limb opening into the bladder and another into the urethra. So long as the fistulous opening into the bladder is inflamed or infected it is surrounded by a red edematous zone. The same condition is found around a partially healed wound of the bladder. When the recovery is established a scar remains with some deformity of the bladder wall and cavity. During the activity of a fistula into the intestines, fecal matter may be seen to pass out of it into the bladder or urethra, as the case may be. Fenwick states that in his case foul products from the dead fetus were seen in and recovered from the bladder. The diagnosis of fistulae between the bladder and the surrounding organs must not rest on cystoscopy alone but should be corroborated as far as possible by a suitable examination of the other organ affected, hence proctoscopy and vaginoscopy and the like should always be resorted to combined, for example, with injection of the fistulous tract with methylene blue, for example, if practicable.

Collargol may be injected into the bladder through the cystoscope and a plate as shown in Fig. 245 then obtained. Young,<sup>1</sup> in the article quoted, describes the collargol injections as follows: "Collargol, 15 per cent., was then injected through each ureter catheter and radiographs taken. The right renal pelvis appeared considerably dilated and irregular, the ureter slightly dilated from kidney to bladder, and the kidney enlarged. The left kidney and ureter show no shadows, but just above the bladder in the left side of the body pelvis a large fusiform shadow is shown (which was supposed to be the diverticulum—the supposition being that the catheter had slipped out of the ureter and was coiled up in the diverticulum)."

#### THERAPEUSIS OF THE BLADDER IN CYSTOSCOPY.

**General Considerations.**—Diagnosis of conditions in the bladder in cystoscopy was considered from the standpoints of inflammation,

<sup>1</sup> Tr. Am. Urol. Assn., 1912, vi, 161.

foreign bodies, neoplasms, abnormalities and aids in operation. Therapeusis of the bladder will be discussed in the same order of subjects.

The procedure of the use of the cystoscope in the treatment of the bladder is much the same as in ordinary cystoscopy. The medium may be water or air, as the occasion demands, with the reservation, however, that a number of deaths have occurred from air dilatation, seemingly through absorption of the air in large quantities by the bloodvessels and its circulation as bubbles in the blood. It is at least necessary, therefore, to follow the precautions of employing as little air as possible not under pressure in the bladder and for the briefest possible time. Oxygen is a much better substitute.

**Therapeusis of Inflammations.**—The therapeusis of inflammations arises from the indications for direct application of chemical, thermal, electrical and mechanical means in cystoscopy.



FIG. 248.—Infantile bladder. The feature is a long prolongation in the urachal or apical quadrant of the bladder terminating in a cavity called infundibulum urachi, difficult to illuminate even in extreme distention, and elevation of the lamp toward it. Marion, Heitz-Boyer, Germain.)

The instruments available are any of the well-known urethrosopes, such as Kelly's, Chetwood's and Young's, and any of the direct-vision cystoscopes such as Braasch's, F. Tilden Brown's, Lewis's operation, the Acmi convex sheath operation and the Buerger operation cystoscope with their accessory equipment of small instruments and the high-frequency current generator and switch.

The lesions of inflammation for therapeusis in cystoscopy are chiefly disseminated cystitis, simple ulcers, and single or few small tuberculous deposits or ulcers.

**Disseminate Cystitis.**—Disseminate cystitis occurs in localized patches confined to small or scattered over large parts of the bladder. These may be through a cystoscopic tube or a direct-vision cystoscope, freed of their coating of pus and detritus and then treated with solutions of nitrate of silver in percentages from 1 per cent. to 10 per cent. followed by irrigation with normal salt solution.

**Simple Ulcers.**—Simple ulcers may, through the same instruments, be treated in much the same manner as the spots of disseminated cystitis, or they may also be, through one of the operation cysto-



scopes curetted or freshened with the rongeur or stimulated or lightly cauterized with the Oudin high-frequency current, thus fulfilling the indication of establishing a new base so far as possible which may take on healing qualities.

**Tuberculous Deposits or Ulcers**, single or few, may, through the operation cystoscopes, be removed both for diagnosis and cure. The bases of such lesions left behind should be well cauterized. Larger tuberculous deposits require, in the opinion of some authorities, fairly active thermocauterization through the tube or electrocauterization with the high-frequency current, or in the judgment of other authorities, open operation and treatment according to indication. The latter, however, seems to be in the lesser favor, because cutting operations rather favor spread of the bacilli through the system. A most important detail in all these tuberculous cases is a recognition and treatment of the primary focus.

**Therapeusis of Foreign Bodies.**—Therapeusis of foreign bodies arises from symptoms and diagnosis in cystoscopy suggesting their presence. Small calculi, fragments of calculi after crushing operations, pieces of broken instruments and material introduced through perversions of the sexual instinct are all included. They all tend to set up cystitis and to augment in size through precipitation of urinary salts upon them so that foreign bodies which might have been readily removed with simpler require graver means.

The instruments available are the Buerger, Brown or Lewis operation cystoscope and outfit, the author's suction attachment for either of the foregoing instruments, Chismore's evacuation outfit, Young's or Walker's cystoscopic lithotrite, Thompson's lithotrite preceded and followed by cystoscopy.

The cystoscopic lithotrite is a comparatively new instrument whose forerunners were instruments of the same type devised by Albarran, Nitze and Bierhoff. The first was fragile and the last two were imperfect in obscuring the object with the jaws.

**Calculi.**—Small calculi or fragments of larger calculi after litholapaxy or pieces of instruments may be removed with forceps through an operation cystoscope, or sucked out with the author's evacuation attachment or a Chismore tube. The manner of using the author's evacuator is that when the object is carefully in the cystoscopic field with the instrument placed with the beak laterally flat on the bladder floor the light is extinguished, the telescope is removed and the evacuation valve and bulb attached and the pumping begun. Thus the fenestrum of the cystoscopic sheath is very near the object before the evacuation is attempted.

Larger calculi or fragments requiring reduction in size may be located with one of the cystoscopic lithotrites with the aid of vision and then crushed and removed, or recognized in the usual way with the Thompson lithotrite or one of its cognates and then crushed and evacuated. Cystoscopy should always be part of these operations, either through the telescope of the lithotrite or of a cystoscope subsequently introduced.

Soft foreign bodies like pieces of catheter which might break or otherwise be inconvenient may be seized in the forceps and engaged in the isthmus of the sheath and everything withdrawn together.

**Therapeusis of Neoplasms.**—Therapeusis of neoplasms in cystoscopy is, in general, contraindicated by malignant tumors of all classes owing to the somewhat restricted facility of approach which the cystoscope affords, and in the opinion of many authorities contraindicated multiple growths of benign character because of the definite tendency these have toward malignancy.

The indications of such therapeusis are prostatic hypertrophy localized in the neck of the bladder as the so-called "bar" and in pedunculated outgrowths of the middle and sometimes lateral lobes. The writer has a case in which a small pedunculated enlargement of the middle lobe acted as a ball-valve in the bladder. It was removed by suprapubic cystotomy undertaken for the purpose of removing the prostate as a whole also. In the exposed bladder this was found unnecessary so that the operation might have been made intravesically through the cystoscope. The most common indication is papillomata, single or multiple, if not too numerous or extensive. Some authorities believe that very early malignancy is another possible indication.

The instruments applicable are Young's prostatic punch, the Buerger-Acmi operation cystoscope, Oudin high-frequency current apparatus, Nitze's cystoscopic electric cautery, Nitze's cystoscopic electric snare, and Young's cystoscopic rongeur.

The prostatic bar and pedunculated small enlargements of the middle and lateral lobes were originally treated by the Bottini operation without the danger of absent drainage and later by the Chetwood galvanocautery knife with the added safety of drainage. Neither of these operations seems to give permanent results. The cystoscope permits approach to these lesions under the eye so that they may be snared off with the hot or cold wire or ablated with the Nitze electric cautery or in the case of the bar a fragment may be removed with Young's prostatic punch, which is in high favor.

Papillomata of the bladder, single or multiple, are treated best with the high-frequency current of Oudin in the method discovered and developed by Edwin Beer, of New York, who describes his technic in the following words: "The essential instruments for this therapy are: (1) a high-frequency machine with Oudin resonator, (2) a catheterizing cystoscope, (3) a heavily insulated copper electrode. Instead of the induction coil and interrupter the latest model instrument uses a closed magnetic field transformer ('step-up') which gives more rapid oscillation and can be employed in any room effectively." Beer<sup>1</sup> further goes on to discuss the actual details of applications as follows:

"The applications were made directly to the growth, the electrodes being pushed a short distance in among the villi under the guidance of

<sup>1</sup>Jour. Am. Med. Assn., May 28, 1910, liv, 1768 and 1769; Am. Surg., 1911, liv, 208; Jour. Am. Med. Assn., November 16, 1912; lix, 1784 and 1785; Med. Rec., February 8, 1913; Am. Surg., June, 1915.

the eye, and then the current was turned on at various points for fifteen to thirty seconds, the bladder being distended with distilled water. In my early seances I made the treatments rather short. The longest total applications that I have used at one seance aggregated ten minutes, thirty seconds at twenty different spots. This was an enormous tumor and so long an application surely is not necessary except in such cases. A total of three to five minutes at one sitting will suffice usually. A few days later it should be repeated, provided any viable tumor tissue is visible, as at the original sitting it is impossible to determine how extensively one has destroyed the growth. Treatments are discontinued as soon as the whole growth appears necrotic. The sloughs are allowed to separate spontaneously or helped along with bladder irrigations. After the base is thus exposed (after two to three weeks) it is treated as were the original outgrowths."

The Oudin high-frequency current is monopolar. A bipolar current is meeting with favor with some operators, for example, Küttner<sup>1</sup> and Keyes.<sup>2</sup> The actual cautery may be applied through a direct-vision cystoscopic sheath, while Nitze has produced a cystoscopic electro-cautery which is available in some cases. Very recently Buerger<sup>3</sup> has produced a series of valuable instruments for operation purposes consisting of a rongeur forceps and a cold wire snare. Nitze<sup>4</sup> has a hot wire snare produced through an electric current made to pass through it. Young<sup>5</sup> has a large rongeur of two blades meeting so as to be like a sound or cystoscope in shape. An inspection telescope passes through their shafts after the instrument is in place and permits the operator to bite off fragments of the growth within the field of the instrument.

A most important function of the cystoscope in neoplasms of the bladder is the securing of fragments for the pathologist. The operation cystoscope is required, through which the Buerger cystoscopic rongeur or the cold snare or the high-frequency electric cable may be passed and so applied as to detach a suitable fragment. It is most important to secure a specimen from the edema and thickening which frequently are at the base of such tumors. The high-frequency current sometimes changes the specimen so that enough should be secured to prevent tissue unaffected in this way.

Bugbee has recently evolved another therapeutic use of the cystoscope, consisting in more or less deep burning of enlargements of the prostate with the high-frequency current. The immediate results of this method are good, and the prospects of its proving successful are excellent. If the remote results are permanent it will largely supplant the more dangerous operation of prostatectomy.

**Therapeutics in Abnormalities.**—As regards treatment, abnormalities of the bladder in cystoscopy consist chiefly of diverticula, their

<sup>1</sup> Inaug. Diss., Berlin, 1890.

<sup>2</sup> Am. Jour. Surg., 1910, xxiv, 205.

<sup>3</sup> New York Med. Jour., 1913, xcvii, 857.

<sup>4</sup> An. d. mal. d'org. genito-urin., 1891, ix, 829.

<sup>5</sup> Jour. Am. Med. Assn., 1913, lxi, 1857.

diseases and treatment. The chief disease is inflammatory, with or without the deposit of calculi. With the cystoscope and ureteral catheters diverticula may be evacuated, irrigated and medicated either through instillations or direct applications. Stones if smaller than the mouth of the diverticulum may sometimes be dislodged with the aid of the operation cystoscope and its accessory instruments. Exploration of diverticula may be undertaken with ureteral catheters, whalebone bougies-à-boule and the later electric bougie-à-boule of Buerger.

**Inspection of the Bladder Cavity During Operation** is another field of cystoscopy. After the bladder is opened through the suprapubic route, the cystoscope may be passed into the wound to illuminate the cavity thoroughly without reflecting into the operator's eyes, as is sometimes inevitable with lights outside the body, or the cystoscope may be passed through the urethra and its light turned on both to illuminate the field and to aid in carrying off blood and irrigation fluid. The immediate field of operation in such a case would have to be away from the lamp or the neck of the bladder.

## CHAPTER XV.

### THE URETERS AND RENAL FUNCTIONAL TESTS.

**General Principles.**—The method of locating the ureters in cystoscopy in health and disease has been discussed in the section on Inspection, Localization and Orientation of the Bladder. The most important detail is the art of focussing the instrument upon the ureteric mouth. First the focus and field of the instrument must be familiar to the operator and next he must be dexterous in adjusting the instrument to various positions with relation to the mouth. The plan of finding the ureters, laid down in previous pages, produces, as a rule, a picture of the mouths from an angle. With the ureter in the center of the field the instrument is rotated until the beak is practically at right angles to the field and then by approach to or recession from the object a clear picture is obtained for definition, anatomy, physiology and pathology. It is often necessary to move the eye-piece up and down or from side to side in order to succeed.

#### THE NORMAL URETER.

**Anatomy.**—The number of ureters is normally two, one from each kidney, and their mouths are constricted by muscular fibers forming a true sphincter and on the bladder floor the papilla of the ureter. The mouths of the ureters are in the ureterotrigonal or posterior inferior segment of the bladder at the angles of the trigonum, usually in its margin but sometimes within the paler part of the bladder or the highly vascular trigonum itself. The situation of the ureteric mouths may be found where the ureteric folds merge into the floor and interureteric bar as the papillæ. Behind the folds and the base is the pouch of the relatively lower part of the bladder floor—the posterior superior segment. They are usually separated by an interval of one and a half to two cystoscopic fields, that is, from 3 to 4 cm. Occasionally, however, one or both are so near the middle line as to bring both within one cystoscopic field, or so far from the middle line as to emerge practically from the side of the bladder well above the floor. In general appearance they are slits about one-eighth of an inch long, resembling infant vulva, with firm clean-cut margins without exposure of mucous membrane or translucency, both of which indicate edema.

The annexa in health depend entirely on the exact location of ureteric mouths and they may therefore be the trigonum in part or whole or the bladder behind the trigonum in part or whole with their respective features. The ureteric and interureteric folds are properly a portion of their annexa and vary from considerable prominence to



practical absence. Careful search, however, usually reveals their representatives.

The length of the normal ureter is sixteen inches, about 40 cm. The caliber of the ureters, so far as cystoscopic investigation is concerned, is determined by the caliber of the meatal sphincter and varies from 1 to 8 F. in the adult with material difference between the sexes. Occasional larger ureteral catheters may be used through the modern cystoscope. Undue stretching of the meatus, however, may temporarily disturb the kidney function and is not advisable. There are three important normal constrictions in the ureter, namely, at the outlet of the pelvis, at the point where the ureter crosses the common iliac vessels, and at the sphincter in the papilla.

**Physiology.**—The normal ureter is manifested by contractions due to the discharge of urine, which vary in number and energy. Bilateral coördination is never present. Activity occurs even after a nephrectomy when one ureter continues to contract regularly although without discharge of urine, of course. Frequency of contraction is increased by stimulation and by compensatory hypertrophy of the healthy kidney in making up the work of a diseased fellow. Frequency of the contraction is decreased by the reflex influence of nervousness and obstruction, and by the altered quantity and character of the urine in nephritis. The contractions are sooner or later commonly absent after nephrectomy, injury of the kidney and ureter or both, and in reflex anuria. Persistence of contraction does not change provided the reflex chain of retrorenospinal action is maintained. In these circumstances they are practically unaltered by operation, disease or fistulae, therefore the actual presence of a urinary discharge into the bladder cannot be a factor in the case. Where there is no efflux of urine the muscular action may continue, if the nervous mechanism is intact.

**Urinary Ejaculation from the Normal Ureter** is, for the sake of full comparison, discussed under the same heading of the abnormal ureter, on the following pages.

### THE ABNORMAL URETER.

Abnormalities of the ureters are anatomical and pathological.

**Anatomical Abnormalities.**—Anatomical abnormalities are those of number, situation and form. The normal number is two, one leading from each kidney, but there may be two from one kidney passing either completely or partially, from kidney to bladder. A similar arrangement as to reduplication may affect both kidneys, thus making four complete or partially complete ureters, or three when there is but one ureter on one side. When the supernumerary ureter is pervious to the kidney it is called complete, and incomplete when the other condition obtains. The additional ureters may be near the normal, which is the common arrangement, or at a relatively great distance from it. The mouth is usually patulous or nearly normal in appearance. The discharge of urine, when the supernumerary ureter is complete, is





FIG. 249



FIG. 250

FIGS. 249 and 250.—Author's case of double right ureter. **Fig. 249 is the upper left pyelogram.** Fig. 250 shows double ureter and pelvis, with **strictured outlet of upper pelvis.**



FIG. 251. — Sharp kink in ureter, demonstrated by soft ureteral bougie. Roentgenogram by Dr. L. T. Le Wald. (Bugbee.)



FIG. 252. — Diverticulum of ureter following operation for ureteral calculus demonstrated by soft ureteral catheter which forms a complete loop in the diverticulum. Roentgenogram by Dr. L. T. Le Wald. (Bugbee.)

dinate with its fellow of the same side and opposite side. Reduction of the ureter may also consist of two outlets from the pelvis unite into one channel before the bladder is reached. Pilcher that he has found three ureteral openings all of normal appearance. All abnormal openings from the bladder should be investigated by the ureterocatheters and x-ray catheters, as a normal healthy ureter may have an abnormal pathologic supernumerary.



FIG. 253.—Soft ureteral bougie in contact with calculus lodged 3 cm. below ureteral orifice. Roentgenogram by Dr. L. T. Le Wald. (Bugbee.)



FIG. 254.—Soft ureteral bougie in contact with calculus in pelvis of pelvic kidney. (Thorium injections failed to demonstrate the lesion.) Roentgenogram by Dr. L. T. Le Wald. (Bugbee.)

Double ureters may lead respectively to healthy and pathological conditions of the same kidney; hence the importance of correct diagnosis. Multiple ureteral meatus are usually easy to recognize in healthy ureters but difficult when the mucosa is altered by inflammation and atrophy.

Other means of diagnosing the action of supernumerary ureters is by the injection of dyes into the circulation, such as indigo-carmin, which do not decolorize in the urine, and then studying their action into the bladder. The use of phenolsulphonephthalein with its excretion through separate urethral catheters, one in each ureter, is also more valuable in the manner described later.



FIG. 255.—Shadowgraph bougie in right kidney; ptosis not evident in recumbent posture.



FIG. 256.—Same case as Fig. 255. Shadowgraph bougie showing ptosis when in upright posture.



FIG. 257.—Shadowgraph bougie showing ptosis of left kidney.



FIG. 258.—Same case as Fig. 257. Shadowgraph bougies in both kidneys four months after operation for fixation of left organ.





FIG. 263.—Shadowgraph bougies in both kidneys, showing prolapse and rotation on left side.



FIG. 264.—Calculi in pelvis of left kidney. Suspicious shadow in right kidney pelvis, and small calculus in lower right ureter.



FIG. 265.—Stricture of ureter demonstrated by collared injection.



FIG. 266.—Combination of ptosis and calculus revealed by ureteral bougie. (Bugbee-LeWald.)



FIG. 267.—Same case as Fig. 266. After operation: note absence of calculus; kidney in upright position, location is low on account of age of patient and long duration of malposition.



FIG. 268.—Sharp angulation of right ureter, caused by exterior adhesions after hysterectomy.



FIG. 269.—Shadowgraph bougies in both ureters, showing sharp angulation on right side causing symptoms.



FIG. 270.—Shadowgraph bougie, showing the anomaly of four separate ureters serving two kidneys.

Abnormalities in the situation of the ureters range from the implantation of one into the prostatic urethra and the other into the bladder and both into the bladder so as to be within one cystoscopic field, to the separation of the two openings from each other and the middle line by the displacement of one or both high up on the sides of the bladder.

Abnormalities in the form of the ureters rest on inflammation, neoplasm and foreign bodies. Inflammation, by thickening the wall of the ureter or the immediate annexa, may change the form from a slit to a rigid hole of various outline, prominence and retraction. Thus are produced "pin-hole," "golf-hole" and other types of ureteral openings.

**Pathological Ureteral Meatus.**—Pathological ureteral meatus are produced by inflammation, neoplasm and foreign body. The inflammatory meatus shows hemorrhage, not necessarily macroscopic, edema, prominence with distortion, recession, rigidity, patulousness, eversion, cystic conditions and obstruction, partial or complete. Stricture of the ureter from inflammation, neoplasm or foreign body above, with secondary interference with the circulation and the urinary efflux, may show many of the foregoing signs of inflammation because this process is really secondary to the causative factor.

Neoplasm of or near the ureter may cause the symptoms of inflammation, but is more apt to produce prominence with distortion, and then by compression, extrinsic or intrinsic of the ureter, the signs of stricture.

Foreign body of the ureter, especially if in the lowest or vesical segment of the canal, causes not only the signs of stricture, partial or complete, but also the signs of secondary inflammation.

Pathological forms of meatus comprise prolapse, stricture, divulsion, tear, contracture and distortion and rigidity. Prolapse of the ureteral meatus is chiefly inflammatory in origin and is due to thickening, proliferation and protrusion of the mucosa exactly as in moderate degree of rectal prolapse. Ureteral prolapse may resemble the mouth of a sinus with exuberant granulations. The muscular band or sphincter of the meatus changes the normal flat relation to the bladder floor to prominence with edema followed by dimpling of the center, infolding with prominence of the periphery and increased congestion even to cyst-formation, by purse-string action.

Stricture of the ureter at the verge of the meatus progressively causes more and more edema and cystic degeneration of the mucosa chiefly through circulatory interference. Stricture high in the ureter is apt to show a patulous meatus through changes in the muscular action and the drainage of the urine, resembling in this detail stricture of the urethra.

Lowsley<sup>1</sup> out of 350 specimens, measured, found the ureteral orifice narrowed in 8 cases. This is about 2 per cent. of the entire number and shows that such narrowing is actually a rare condition.

Ureteral calculus, if recently expelled, leaves a divulsed meatus with

<sup>1</sup> In a personal communication to the author.



gns of tears much like those in the mucosa after an anal divulsion. This condition with the stone in the bladder fixes the diagnosis. If the one is below the pelvic brim, its pressure and the chronic inflammation of its presence produce edema, which may or may not obscure patulousness.

Contractures and distortions of the ureteral meatus are usually found with ulcer, deep traumatism, tuberculosis and neoplasm. The latter, if unhealed, at once reveals itself. If healed, its scar or the scar of traumatism suggests the origin of the deformity. Tuberculosis of the ureter usually sets up a condition known as "golf-hole" ureter, a round hole somewhat depressed with more or less inflammation of the mucosa and often the presence of tubercles around it. Rigidity of the ureteral meatus is a very common sign of tuberculosis. Neoplasm, depending largely on its situation, may determine almost any possible defect on the ureteral outlet.

**Diagnosis.**—Pyelonephritis of long standing is usually accompanied with chronic infection of the ureter and therefore shows inflammation of the ureteral meatus with edema, patulousness and much pus.

Tuberculosis of kidney and ureter is usually revealed by edema of the meatus, indolent inflammation, large or small quantities of pus, with bleeding as a prominent symptom, not so much in quantity as in continuity and recurrence. There is practically always some blood, either on microscopic or macroscopic examination. As the disease infects the lower zone of the ureter thickening and retraction of the meatus to a "golf-hole" type occurs.

Hydronephrosis affects the ureter through pressure and gives a peremic, edematous meatus. When the ureter is closed there will be no urine only possibly mucus and pus; while it is open the flow of urine, containing mucus and pus, will be redundant.

Stone in the ureter or kidney gives a meatus with inflammation of the more active type and mucus and pus in slugs and strings, difficult to catch with the ureteral catheter which is usually obstructed. Partial or complete obstruction produces obvious change in the quantity of the efflux.

Neoplasm of the kidney and ureter is apt to give great hyperemia of the meatus and when bleeding occurs it is in gushes of rather large quantity.

Ureteral disease, in brief, therefore, is suggested by definite changes in the form, size, prominence, patency, elasticity and muscular action and excretion of the ureters. Study of these various and important factors is the first step toward a diagnosis.

Pathological ureteral evacuation includes urine, mucus, blood, pus, gravel and dyes, experimentally injected for the study of the function of the kidneys and their ureters. The normal efflux is included in the following description for the sake of comparison.

The sign of ureteral activity is a relaxation of the ureteral sphincter shown by an opening by the normal slit and followed by a swirl in the contents of the bladder which tends to rise if the specific gravity of the



urine is low or to fall along the bladder if it is high. If the meatus is rigid the muscular action is not apparent. If the efflux is not normal urine and the bladder contents are clear, then as the case may be, the blood, pus, mucus, flakes, fat, phosphates or dyes are at once seen in contrast as they emerge in slow or rapid, large or small discharges.

The ureteral discharge is definite in its regularity and coincides with the contraction of the ureter. It is increased by those factors which increase the contractions, and decreased by those which decrease the contraction, such as obstructions. It is absent, as a rule, in complete obstruction and after nephrectomy, and also with anuria of reflex origin, as previously discussed under physiology of the normal ureter.

Blood in the urine discharged from the ureter may be microscopic and is discovered only by ureteral catheterization. Likewise many of the other abnormal constituents of the urine, or the blood may be macroscopic in quantity, appearing as jets or puffs floating across the field like the classic pictures of volcanic eruption. Confusion in the cystoscopy is often cleared by using the irrigation cystoscope or a cystoscope with two ureteral catheters in place as the inflow and out-flow channels.

Annexa of pathological ureters correspond with the diseased ureter or kidney, and thus are leads toward suggesting a diagnosis. The fact that the vault of the empty bladder collapses upon the floor frequently leads to affections and infections of it at the point opposite the diseased ureter. This is particularly true in tuberculosis and is doubtless due to washing of the germ-bearing urine upon such portion of the bladder as it lies over the diseased ureter.

The annexa of ureters in pathology present every possible gradation of congestion, inflammation, edema, rigidity, prominence, inelasticity and deformity. A very important feature for recognition is tubercles about a suspected ureter, while there are still but two or three, and before they become numerous and ulcerous.

**Indications.**—Indications of pathological ureters are always to explore and investigate the ureter and kidney of the affected side and of the normal side for comparison in all accepted ways, particularly cystoscopy, ureteral meatoscopy, ureteral catheterization without and with *x*-ray photography, and the functional renal tests. This series of steps is comparable to a thorough investigation of the pulmonary system from nose to lungs in suspected tuberculosis.

The foregoing description of the various changes in the ureteral meatus is suggestive and not conclusive of diagnosis. No experienced cystoscopist would ever endeavor to reach a decision in any case from the appearance of the ureteral meatus and its annexa alone. This is particularly true in the earlier degrees of disease precisely when modern diagnosis aims to be reliable and when operation is most safe. Quite to the contrary the skilled observer suspends judgment until he shall have secured all possible data.

The ureteral meatus shows signs of disease chiefly when the intrapelvic segment of the ureter, namely, the distal third is involved. This

lly true in the progressing lesions, such as tuberculosis among tions, neoplasm and migrating stone. Disease in the supra- ment or proximal two-thirds of the ureter, embracing the id its pelvis also, often may, but does not always, show changes reteral meatus. The uncertainty of these facts is another r exhausting every detail of diagnosis for a conclusion.

### URETERAL CATHETERIZATION.

**naries and General Considerations** essentially include knowl- he anatomy, topography and orientation of the bladder in l females, in adults and children. Naturally such knowledge that of the anatomy of the ureters and the kidneys and also iology, as influenced by such factors as nervousness, fear, food, ugs and disease. Appreciation of the possibilities of damage ent to the urinary organs, during examination, must be alive . Skill with the mechanism and familiarity with the electrical



—The bulbous ureteral catheter and telescope. One of the author's set of heters is shown adjusted to the telescope, with the bulb beyond the tip of the as to be accommodated by the sheath. There is no other way to use or pass il ureteral catheters. (Original.)

he cystoscope must be subconscious with the operator. No may conscientiously undertake these investigations in the of such training.

ation of the patient and bladder requires all forms of asepsis sepsis at the time of the examination, internal medication, of urinary antiseptics, and the postoperative irrigation of ler and instillation of weak silver nitrate solution, as pre- against infection and secondary urethral chill and anuria, as in fuller detail in previous chapters.

**mentarium.**—In addition to the ordinary examining cystoscope he accessories previously discussed, there will be required eterizing telescope and the ureteral catheters and stilts. eterizing telescopes have already been described in detail on

**of Ureteral Catheters.**—The best forms of these instruments ench manufacture and have the following features: The tips m, conical, olivary, and most serviceable, "flute-end" with a and two-side openings, respectively 1 and 2 cm. from the tip

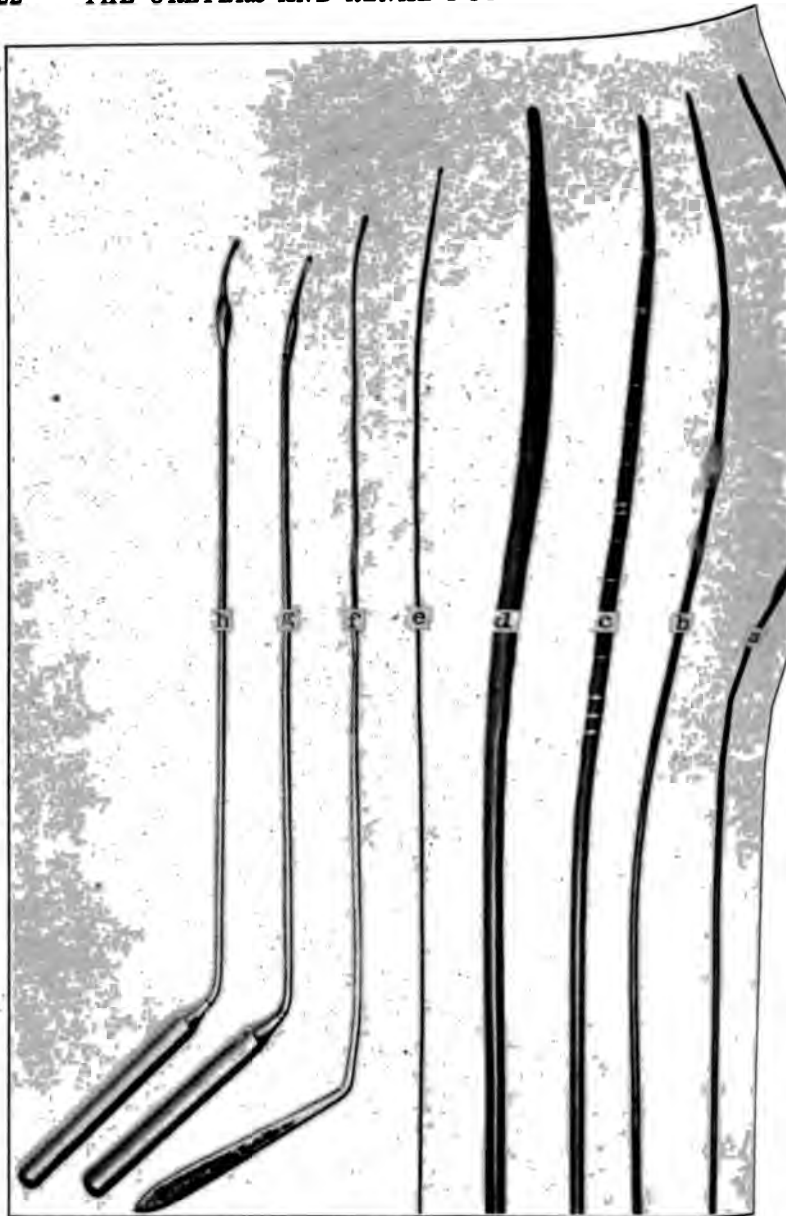


FIG. 272.—Ureteral exploring instruments: (a) blunt, round tip renal catheter with wax bulb; (b) olive tip renal catheter with large wax bulb protected on either side with smaller bulb; (c) Cunningham graduated whistle tip catheter; (d) flexible bougie (7 mm. diameter). Sizes vary from 3 to 10 mm., the smaller sizes being useful for dilating through the cystoscope from below, and the larger sizes for retrograde dilatation from above; (e) whalebone filiform, varying sizes are used through the cystoscope; (f) metal searcher with olive tip; (g) metal bulb dilator 3 mm. with curved olive tip; (h) metal bulb dilator 5 mm. with curved olive tip. (Hunner.)

Jour. Am. Med. Assn., April 1, 1911, lvi, 937 to 941; Surg., Gynec. and Obst., October, 1910, pp. 444 to 457; *ibid.*, May, 1910, pp. 485 to 493; Internat. Clin., vol. iv, Series 22.

and at opposite poles of one diameter. The other forms of tip necessarily omit the terminal inlet. Storage and sterilization of the catheter are fully described in the section on Equipment and Preparation for cystoscopy on page 711.

Mensuration of the penetration of the catheters into the ureters is provided by color bands, each 1 cm. wide, and alternately black and yellow or black and red, beginning at the tip and continuing to the funnel or cylindrical end. Every 5 cm. special gilt bands are put in order to facilitate the correct measurement, as follows: at 5 cm. one gilt band, at 10 cm., two, at 15 cm., three, at 20 cm., four, and at 25 cm., either five narrow or one wide gilt stripe. After this point is reached, the same system of marking the next 25 cm. is repeated so that the 1 cm. point, for example, is recognized by one narrow band proximal to the operator beyond the wide stripe or the five narrow stripes of the 5 cm. point.

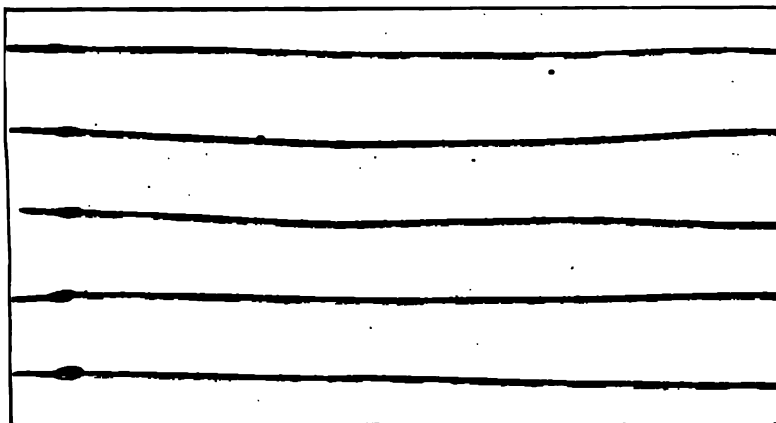


FIG. 273.—Author's set of bulbous catheters. These bulbous catheters tend to prevent leakage of urine around the catheter and thus to make the quantity of urine collected more accurate. The size of the catheters is 5 to 6 F. for the set and the sizes of the bulbs are stepped regularly 8, 9, 10, 11 and 12 F.

It is well to repeat here that the normal ureter in the adult is about 10 cm. long.

The diameter of the ureteral catheter varies from 3 F. to 8 F. Hardly any double catheterizing cystoscopes readily accept larger than two F. instruments. The operation cystoscopes, however, will accept one size 7 F. and one 8 F. or possibly two 8 F. The average ureter, on account of the normal narrowings near the bladder, over the iliac vessels and at the renal pelvis, permits complete passage of only 5 F. or 6 F.

X-ray ureteral catheters are made, whose walls are permeated with the salts of bismuth, lead and silver. These are not so satisfactory, however, as the insertion of a stilet into the catheter. These stilets are made of two strands of piano wire twisted for flexibility and having an

outside diameter suitable for the lumen of all common sizes of catheter. Their flexibility is such that they will coil in bladder, ureter, or kidney pelvis, without damage to the mucosa.

**Advancement of the Ureteral Catheter** is procured by patience and gentleness to avoid spasm, pain and chafing of the mucosa. The direction of the catheter should be as nearly as possible in the axis of the ureter, which in axial vision cystoscopes is secured by carrying the eye-piece to the opposite side and upward, each about three inches, until the ureteric mouth is in the middle of the field and more or less at right angles to the instrument. The same object is secured with the laterovision cystoscope by variations in the positions of the reflector and by similar arrangement of the cystoscope, making special use of rotation. The moment of relaxation of the ureter for discharge of urine is favorable for entrance and advancement of the catheter. Rapid and rough handling of the catheter are not advisable and in every case the eye of the operator should watch the entire procedure.

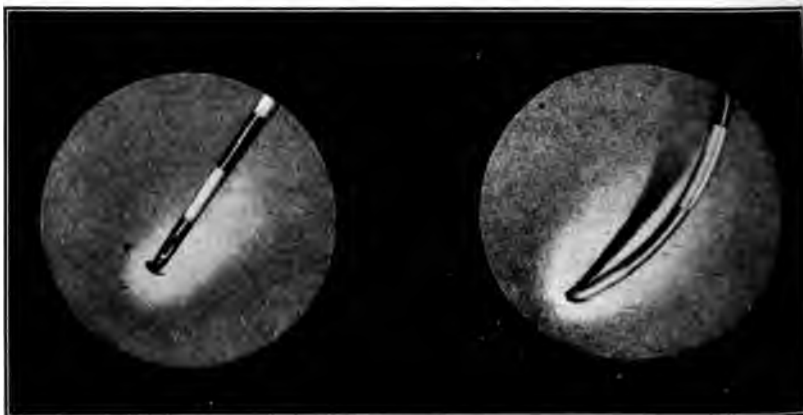


FIG. 274

FIG. 275

FIG. 274.—The catheter is advanced toward and engages in the meatus, without ever covering it from view. (Pasteau and Ambard.<sup>1</sup>)

FIG. 275.—The catheter has penetrated the meatus and gently curves as it is advanced. (Pasteau and Ambard.)

**Degree of Penetration of the Catheter** is various. The normal length ranges from 45 cm. to 40 cm. as extremes and from 27 to 35 cm. as the common limits. For simple diagnosis of separate specimens of urine, 5 cm. to 10 cm. penetration are enough. To establish the patency of the entire canal, to wash out the pelvis of the kidney and to treat the ureter as a whole, the catheter should be advanced into the pelvis of the kidney. Proof that the pelvis has been entered is established by the loss of sensation of easy progress, by bending of the catheter in the bladder under the eye at further attempts at advancement, and usually by the steadier and less rhythmic dripping of the urine.

<sup>1</sup> Encyclopédie Française d'Urologie, 1914, ii, 69.

**Duration of Retention of the Catheter.**—Simple exploration for patency requires no retention. Diagnosis which rests on individual urine from each kidney demands from one to two hours; while lavage and drainage of the kidney and ureter permit several days' retention, very much as is the rule in corresponding urethral conditions.

**Character of Urinary Excretion.**—A few drops in rapid succession at definite intervals and with certain rhythm mark the normal excretion of the urine, but the two kidneys rarely act at the same moment. Continuous arrhythmic dripping usually indicates that the upper zone of the ureter or the renal pelvis has been reached or that there is present one of the following conditions: polyuria, dilated ureter, hydronephrosis, pyonephrosis, calculus and reflux of the bladder contents of the ureter when the catheter is too near the entrance. Displacement of the catheter into the bladder also gives continuous dripping. Thus, it is always necessary to investigate the source of this form of discharge.

Absence of dripping of urine may mean temporary reflex anuria which passes away in about ten minutes; the longer the interval, especially about an hour, the greater the likelihood of a pathological basis. Absence of dripping from a catheter which was previously discharging indicates a plugged tube through mucus, blood, pus or calcareous deposits—best relieved by withdrawing and flushing the catheter into the bladder. Leakage around the catheter, recognized by the swirl of the urine, leads either to absence or irregularity of the usual drops from the catheter.

**Management During the Securing of Specimens** respects the patient's comfort and requires the electricity to be turned off to prevent the risk from burning the mucosa, the foot-rest up, the lower extremities drawn, a Wolbarst or other basin between the thighs as a bottle-rest and reservoir for leakage, and finally a support for the cystoscope if retained.

Various mechanical devices for retaining the cystoscope for purposes of teaching and collection of separate urines have been devised. Among the best is that of Friedman.<sup>1</sup> On the whole the author prefers no such device, as their rigidity is apt to cause pain to the patient during slight movements, even that of respiration. The cystoscope had best be removed during the taking of specimens, of course after the urologist is satisfied that the catheters fit the ureters and that the urine is not leaking unduly about them. For teaching purposes the demonstrator may sit slightly to one side and by steadying his forearm and hand against the table or the buttock of the patient secure all the fixity necessary.

**Withdrawal of the Catheters** requires the following details: slowness, gentleness, preferably observation with the cystoscope reintroduced, instillation of weak silver nitrate solution into the ureter if the likelihood of direct infection from the bladder is feared, study of the molded form of the catheter if present, evacuation and preservation of the

<sup>1</sup> Jour. Am. Med. Assn., 1914, lxii, 453.



bladder contents for analysis, and finally the toilet of the bladder itself with continuation of urinary antiseptics by mouth for a few days.

**Molding of Retained Catheters** may suggest the form, direction, displacement, deviation or deformity of the ureters, through the softening of the heat of the body and the normal pressure on it. It is therefore of service, after withdrawing the catheters, to observe whether such molding has occurred.

**Ureteral Meatoscopy without Ureteral Catheterism** concerns both the ureters and the kidneys, but has many limitations and uncertainties and cannot be relied on for more than suggestive rather than final diagnosis. The diseased condition must affect the mouth itself, which is, therefore, most common when the lower third of the ureter is involved, below the brim of the true bony pelvis. The commonest conditions are inflammations, especially tuberculosis, calculus and tumor low down. In the upper two-thirds above the brim of the bony pelvis, mere meatoscopy is of little value in suggesting the nature of the disease of either ureter alone, kidney alone, or both. In long-standing disease of the kidney, with slow descent of the process to the region of the terminal third of the ureter, meatoscopy becomes more valuable, but then only because it may recognize the condition of the ureter.

For these reasons it is best not to rely on meatoscopy but always to resort to catheterization.

**Advantages.**—The advantages of ureteral catheterization concern both the ureters and the kidneys.

**Ureteric Conditions Diagnosticated by Ureteral Catheterization** become most important in disease of long standing, as in health the procedure is frequently not necessary and almost always very simple. The features elucidated are position, number, condition, patency and form of the ureter. In all these the catheter is an exploring, evacuating and verifying tube.

The number of ureters may be the normal two, or abnormal variations on either or both sides as subsequently explained.

The position of the ureters may be normal, at each angle of the trigonum, but either or both may be displaced nearer or farther from the middle line, even to the walls of the bladder.

The condition of the ureters may be normal or the result of inflammatory and similar changes.

The patency of the ureters may be varied from the normal 5 F. to 6 F. by constriction due to malformation, to pressure by external organs such as the uterus and prostate, to kinks, to aberrant bloodvessels and to inflammatory deposits. Calculi acting as foreign bodies may block the ureters and thickening and stricture of the wall may almost close them. Dilatation of the ureters is looked for in pregnancy, spinal paralyse affecting their muscular walls—both giving relaxed patulous mouths into which very large or even two catheters may be passed. Dilatation of the ureters proximal to obstruction is shown by a steady flow of the retained urine in rapid drops rather than in periods of dropping.

The form and direction of the ureters may vary in health and disease. Catheters frequently mold themselves and after withdrawal will temporarily resume the shape of the canal and thus assist in this element of diagnosis.

X-ray ureteral catheters, including both the use of the stilet and the catheters impregnated with bismuth and lead, are of great value in diagnosis. Under this heading belongs the injection of ureters and renal pelvises with solutions impervious to the x-rays, such as collargolum, gyrol and the like.

**Renal Conditions Diagnosticated by Ureteral Catheterization** include the various functional tests in health and in actual or supposed disease. Urinary specimens may be secured in nephritis, pyuria, hematuria, hydronephrosis, lithiasis, neoplasm, neurosis, displacement and malformation.

**Dangers and Accidents** include ascending infection and traumatism, especially perforation, bleeding, obstruction and leakage prevented by gentleness and observation.

Infection of the ureter by catheterization must be very rare inasmuch as nearly all authorities who have had large numbers of these cases have failed to report such accidents. The writer has, himself, never encountered an example. Its prevention involves only clean instruments, a bladder as clean as possible, anteoperative and postoperative administration of urinary antiseptics, and if necessary, the instillation of very mild antiseptics into the ureter after the catheter is withdrawn, precisely as in the urethra.

**Traumatism and Perforation of the Ureters** are avoided by patience and gentleness and respect for the facts that the ureter is delicate and that disease may still further weaken the tissue. Delay may permit catheter to mold itself and subsequently pass along the ureter obviously seemingly obstructed.

**Bleeding During Ureteral Catheterism** proceeds from breaks in the lining of the catheter, edema, and congestion or inflammation, deviations in the course and caliber of the canal, and the disturbance of impacted stone. The bleeding points may be minute so that further advance of the catheter beyond them checks the blood. Or the bleeding may be followed by more or less cessation of the urinary output, which proceeds from clogging of the eyes with clots. It is corrected best by withdrawing the catheter into the bladder and under the eye, flushing clean and replacing it in the ureter. More active bleeding requires rest in bed, the usual sedatives and postponement of the examination.

**Obstruction to the Catheter in the Ureter** proceeds from the following causes, fully discussed in subsequent pages on Pathological Ureteral Lesions: small meatus, muscular spasm of the walls which is usually overcome by waiting, deviation, curves and kinks in the course of the catheter, which are sometimes passed by permitting the catheter to mold itself in conformity therewith, deformity, distortion and stricture in places which are frequently impassable, pressure from without the ureter by tumors, aberrant bloodvessels and displaced viscera and

within the caliber by impacted calculi which may be circumvented by patience and various trials with other catheters.

**Leakage Around the Catheter** is very common but usually of small amount and negligible. If copious it nullifies the specimens collected and should therefore always be watched for during a catheterization of the ureters. Change to a larger size of catheter will correct it except in cases of dilated, diseased canals in which catheterization is usually a failure on this one account.

**Confusion of the Catheters from the Two Sides** is an error easily prevented by one of two precautions: The catheters may be of different sizes, for instance, 5 F. and 6 F. or 6 F. and 7 F. They may also be selected with different markings, black and red for one side, black and yellow for the other, or the 5 cm. subdivisions may vary and thus distinguish them. The author uses a very simple and reliable expedient, which is to cut the end of the left catheter obliquely and the end of the right catheter transversely across. Thus each side is always distinct from the other side.

**Aids.**—Aids in ureteral catheterization include observation of the swirl of the urine and the injection of dyes whose appearance in the bladder is commonly very prompt. Indigocarmine and methylene blue are among the most common. Turbid medium indicates removal, irrigation of the bladder and renewal. Constantly recurring turbidity requires steady irrigation through an irrigating cystoscope so as to wash the field clear ahead of the objective and catheter.

**Technic with Axial Vision.**—**Cystoscopes.**—Introduction of the cystoscope is fully described in the section on Inspection, Localization and Orientation of the Bladder on page 742. Any single or double, direct- or indirect-vision catheterizing cystoscope may be used, such as have been discussed in the section on Perfected Types of Cystoscope on page 704. The bilateral catheterizing instruments are universally preferred. Of the axial vision, Brown's and of the lateral vision, Buerger's instrument will serve for illustration.

1. The instrument closed with its obturator is passed into the bladder, whose toilet is performed if possible previously, otherwise through the sheath of the instrument. With the bladder at least partially dilated, the obturator is withdrawn, the flow of dilating fluid stopped with the finger or thumb and the catheterizing telescope, carrying the ureteral catheters with their permeability duly proved, with their proximal ends plugged with pins or tooth-picks and with their point of entrance through the catheter tubes tightly washered, to prevent leakage, and with their tips placed just out of the field of vision; in other words, with details in readiness and in working adjustment, is inserted.

2. The interureteric fold and margin of the trigonum and right ureter are located as described on pages 750, 751, 761 and 826.

3. Maintaining a good focus and clear field, the instrument is steadied with one hand resting either on the table or on the patient's buttock.

4. The right catheter is now advanced until its rounded point presents well across the field for perhaps two-thirds of the field and is ready to approach within a short distance of the ureteric mouth.

5. At least half the length of the ureteric mouth should be kept in view and the whole length never obscured by the catheter, precisely in target practice, the sight never fully covers the bull's-eye but only small lower portion of it, so that the bull's-eye and the rifle sight are always distinct from each other.

6. With the catheter just across the field and presenting at the lower half of the ureteric mouth the cystoscope and catheter as a unit are manipulated and advanced until the tip of the catheter engages in the ureter first along the lower portion.

7. The cystoscope is now steadied as before and the catheter advanced with the free hand up to the desired limit of penetration in the ureter, usually from 3 to 10 cm.

8. With the right ureteral catheter in place sufficiently to avoid its withdrawal as the cystoscope is moved about, the instrument is made to traverse along the interureteric bar and margin of the trigonum to the left ureter, which is catheterized in the same way. With the experience and knowledge of the right ureter, already gained, the left is usually more easily entered.

*Retention of the cystoscope* has the following advantages with whatever type of instrument is employed. The light may instantly be turned on for recognition of difficulties, the verification that the catheters are in good position, the determination of leakage around the catheters, the evacuation of such leakage, if it causes painful distension, and the elimination of the likelihood of disturbing the catheters in the attempt to withdraw the cystoscope. The disadvantages of this procedure are irritation, especially in sensitive bladders, pain and discomfort from the weight of the instrument even if well supported, and most important, a tendency to stimulation or inhibition of the kidney function, which usually suffers somewhat from the ureteral catheters themselves, and may accordingly show reflex polyuria or oliguria.

*Withdrawal of axial vision cystoscopes and freeing the catheters* is probably the better procedure and has the following steps:

1. Advance each catheter, if possible, several centimeters into its ureter, to allow for unavoidable slipping in the subsequent manipulation.

2. Turn off the light so that the whole instrument will be cold and the patient not made to jump by the touch of the hot lamp.

3. Remove the caps or washers from the catheter canals in the cystoscope, and next slip them off the catheters themselves, both to provide unimpeded passage of the catheters through the canal.

4. Hold the catheters about 5 cm. away from the eye-piece to prevent any pull from the ureters during the next step.

5. Unlock the telescope and pass it backward to the hand holding the catheters which may then also seize the eye-piece.

6. The other hand now disengages the catheters from the catheter grooves of the telescope and pulls them through the canals.

7. The same hand then steadies the sheath and the catheters at the meatus while the telescope is passed out of the sheath and over the catheters.

8. With the catheters in one hand free from their grooves and between the hub of the instrument and the lamp, the other hand slowly withdraws the sheath, being careful not to disturb the catheters.

9. When the cystoscope is out the presence of the catheters in the ureters is shown by the intermittent dropping of the urine present previous to the manipulation. If the flow is in steady drops without intermission from either or both catheters, it is safe to assume that they have been displaced. If there is the slightest doubt, a small observation cystoscope should be introduced for final decision.

**Difficulties with Axial Vision Cystoscopes** vary in health and disease and rest on the fact that the field is directly ahead of the observer and that the instrument must be shifted through a wide radius in order to gain a view of the upper and lower anterior segments of the bladder.

In health these difficulties rest on the anatomy of the trigonum, which is usually flat but may be markedly convexed by the prostate and uterus or concaved by the vagina in women.

In perivesical disease in females cystocele causes a deep concavity of the bladder and the application of the vaginal elevator to steady and enter the ureters. Uterine enlargement in menstruation, pregnancy, displacement and tumor makes the trigonum prominent and rounded. In males, generalized enlargement of the prostate repeats this deformity or a single lobe may project over one ureter.

In intravesical disease recent inflammation through swelling and edema makes the ureters difficult to find except with the aid of dyes and the swirl of normal or abnormal urine.

Old inflammation causes deformity, distortion and contraction, and may require dilatation with ascending sizes of catheter reinforced with stilets or with the ureteral bougies-à-boule of Buerger before competent catheterization can be accomplished.

Old dilated ureters may readily be entered but the amount of leakage around the catheters renders the observation of these specimens unreliable.

**Technic with Laterovision Cystoscopes.**—Introduction of the cystoscope has the same details as the axial vision instruments. The Buerger double catheterizing instrument is taken as the model of this class. It is assumed that a previous exploration of the bladder has been made with the simple examination instrument, otherwise this telescope may be employed before the catheterizing telescope is introduced.

1. The instrument occluded with the operator enters the bladder previously prepared; if not, its toilet is performed through the sheath of the instrument and the bladder left dilated. The obturator is withdrawn, loss of the contents stopped with the thumb and the catheterizing telescope armed with its catheters tested for permeability, plugged

: their proximal ends and washered at the canals to check leakage, lubricated, and placed with their tips on the deflector, is passed seated and locked in the sheath. Every mechanical and electrical detail must have passed inspection.

2. The air bubble is located and the instrument rotated through 30 degrees, the interureteric fold and margin of the trigonum recognized, and by rotation of the instrument to the left through from 40 to 60 degrees the right ureter is located.

3. With correct focus and definite field the instrument is adjusted and steadied with one hand placed on the table or patient's thigh so that the ureteric mouth is in the upper part of the field.

4. The right catheter is now pushed well across the field and directed with the deflector until well in the axis of the ureter.

5. About half the length of the ureteric mouth should be kept in sight and never covered with the catheter for the reason explained in the technic of the axial vision instrument.

6. From this position cystoscope and catheter as a unit are manipulated and advanced until the tip of the catheter enters.

7. The cystoscope is now rested in one hand as before and the catheter pushed onward with the other hand to the desired 3 cm. to 4 cm. of penetration. Lowering of the deflector often frees the catheter and permits easier advance.

8. The experience and knowledge gained in placing the right ureteral catheter at sufficient depth to prevent displacement, the cystoscope is rotated in the opposite direction until the left ureter is found. The steps of entering it are the same as those for the right side.

Another means of locating the ureters is to withdraw the instrument until the neck of the bladder appears at one margin of the field, then rotate it through nearly 180 degrees and slowly advance it really along the lateral border of the trigonum until the ureter is found at or near a right angle. Of the two, this is the less satisfactory method.

**Withdrawal of the Laterovision Cystoscope and Freeing the Catheters** presents the following details:

Steps one, two and three are the same as in this procedure with the axial vision instrument.

The next step is to remove the cystoscope, remembering that its beak is downward. This may be done in two ways: The eye-piece may be depressed in the middle line of the body five or six inches and then with the reverse steps of withdrawing a sound, removed from the bladder and urethra, following at their proper moment and manner steps four, five, six, seven, eight and nine described for the axial vision instrument.

Or the proceeding may be as follows: The foregoing depression is made and then the eye-piece of the instrument is carried laterally until against one of the patient's thighs. These two motions pass the beak first above both, then over and to the side of one ureteral catheter. The eye-piece is now elevated in the plane of the patient's thigh for five or six inches and then carried over to the middle line. These



two motions pass the beak under the one and finally between the two catheters. From this position it is withdrawn by the same steps as stated above, remembering that this second technic crosses the catheters one above the other. If, however, the catheters of different sizes and of different markings have been used, no inconvenience or error will ensue.

**Technic with Urethracystoscopic Tubes.**—Special instruments for Kelly's ureteral catheterism tubes include a set of dilating instruments or the Kelly urethral dilator, a set of tubes and obturators, several catheters and syringes for evacuating the urine, Kelly's bladder forceps for swabbing the mucous membrane, probes for recognizing the ureters, and finally, a stock of ureteral catheters.

**Introduction of the Instrument.**—Kelly's cystoscopic tube was the original type and is taken as the example for the technic of all other tubes such as Pryor's, Cullen's, and Luys'. Kelly's illumination is by reflected light from a head mirror while others use an electric lamp placed near the objective end. The steps of the examination are as follows, including the usual preliminaries described for the other instruments:

1. Empty the bladder with a soft-rubber catheter.
2. Anesthetize the bladder with 2 per cent. alypin solution and the urethra with crystals of alypin, cocain, novocain or eucain.
3. Dilatation of the urethra is usually required with bougies-à-boule, straight sounds or the conical dilator of Kelly in order to accept the largest tube reasonably possible.
4. Sym's, the genufacial, or Trendelenburg's posture is preferred. The last has the advantage of causing the abdominal contents to gravitate away from the bladder and permit more ready entrance and examination of it. In fleshy patients, when possible, the genufacial position relieves the bladder best.
5. Passage of the largest tube possible without traumatism is easy with the obturator in place and guided by the finger when required.
6. Withdrawal of the obturator is followed by the outlet of urine in the bladder and the inlet of air from the dilatation.
7. Illumination is now turned on and the bladder cavity explored in exactly the same manner as with any other direct-vision instrument, including the detail of search for the ureters.
8. Residual urine, if present, is pumped out with catheter and syringe or wiped away with the swabs on the vesical forceps.
9. Passage of the ureteral catheter requires dryness and cleanliness of the field, presence of the ureter at the objective end, pressure of the tube against the mucosa to aid in keeping out urine from the other ureter, gentle passage of the catheter to the desired depth, followed by search and catheterism of the opposite ureter by exactly the same steps.

**Withdrawal of the Kelly Tube** is performed in much the same manner as the same detail with the other instruments and the collection of the separate specimens is similarly managed. Errors with the Kelly tube

is chiefly due to the similarity between the ureters and other depressions of the mucosa. Distinction is obtained by exploration with catheters before the catheters are passed.

**Advantages of Kelly Tubes are:**

1. The field may be kept dry and not infected from the rest of the bladder for the passage of the catheter.
2. The presence and condition of both kidneys may be quickly cognized as with any other cystoscope.
3. Ureteric conditions of any type may be explored with facility.
4. Catheters retained in the ureters serve as landmarks during extensive pelvic operations and thus prevent damage of the ureters.

**Technic with the Braasch and Elsner Cystoscopes.**—As previously described these instruments are virtually modified tubes and axial vision instruments.

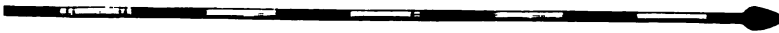


FIG. 276



FIG. 277



FIG. 278



FIG. 279



FIG. 280



FIG. 281

**Figs. 276-281.**—Graduated ureteral catheters. Fig. 276, ball-pointed exploring instrument. Fig. 277, round-pointed, double eye, Pasteau catheter with centimeter graduations, but without five centimeter graduations. Figs. 278, 279 and 280, respectively, the round-, whistle- and olive-pointed Albarran catheters with double eyes and centimeter and five-centimeter graduations. Fig. 281, catheter of Albarran with ruler three centimeters from the tip.

General preliminaries and introduction of the instrument are the same as with all other cystoscopes just described with the following conditions:

1. The obturator is withdrawn and the air-tight window sealed.
2. Toilet of the bladder if not previously performed requires inflation with water and in and out irrigation, the supply tube being attached to the stop-cock and the outflow occurring through the catheter tubes provided with short rubber tubing, permitting shutting off of the flow by pinching them against the eye-piece.
3. Exploratory cystoscopy and search for the ureters follow in the same manner as for the axial vision instruments.

4. Dilatation is maintained with air or water. Air is not without danger of absorption and embolism as proved by case reports in literature. Water is preferred to air and according to Braasch should be under slight continuous flow during the operation.

5. After the ureter is located, the catheter sterilized is brought to the operator with sterile instruments and engaged in its canal in the same way, next advanced along the canal over the field of vision and into the ureter. Simple diagnosis requires a penetration of 10 cm. while full exploration of ureter and kidney pelvis demands the full advance of the catheter.

**Choice of Instruments.**—Choice of instruments for ureteral catheterization is practically the same as for ordinary cystoscopy. The beginner should be so skilful with the axial vision and the laterovision cystoscope of a type with which he is familiar, that the purchase of many instruments is unnecessary and ill-advised. For this reason the axial vision instrument of Brown or one of its modifications and the laterovision instruments of Buerger, or one of its foreign equivalents are all the required set for a very large number of average cases. Other instruments may be purchased as need may arise.

### PATHOLOGICAL URETERAL SEQUELÆ.

**Varieties of Pathological Ureteral Sequels.**—Certain ureteral conditions of great importance have definite subjective and objective symptoms like diseases, although not diseases but only pathological sequels. The most significant are stricture, obstruction, dilatation, wounds and fistulæ.

#### URETERAL STRICTURE.

**Varieties** include anatomical and pathological varieties. Anatomically the ureter shows normal narrowings at the renopelvic outlet, the iliac vessels and the bladder wall. Pathological constriction is most common at the meatus but like urethral stricture may present at any point. The degree of closure varies from moderate to tight, but is rarely complete, and the varieties of the lesion are dilatable or soft and rigid or hard.

**Etiology.**—The causes of ureteral stricture, like those of urethral stricture, are intrinsic and extrinsic, both within and without the ureter, and are essentially inflammatory from underlying infection, traumatism and foreign body.

**Pathology.**—The pathology of ureteral stricture resembles the results of inflammation in all mucous membranes and presents, therefore, inflammation, infiltration, scar and contracture. Alterations in the caliber of the canal affect the ureter above and below the stricture, resulting in dilatation above and atony below with more or less intermittent or chronic discharge of mucus, pus and blood, in strings and shreds, exactly as in urethral stricture.

**Sequels.**—The sequels of ureteral stricture in the bladder occur only when it is near or at the meatus and affect the floor with congestion,



lema and cysts. In the ureter the results above are dilatation with atony, and below altered activity with atony. Both involve more or less chronic inflammation. In the kidney the outcome is at first dilatation of the pelvis, then hydronephrosis, and finally pyelonephritis. A partial stricture rendered suddenly complete causes cessation of renal function. On the affected side the foregoing changes occur while on the normal side compensatory hypertrophy and overactivity of the kidney occur.

**Diagnosis.**—Ureteral stricture is suggested by subjective pain and discomfort varying with the lesion in situation, degree and constancy. Proof of ureteral stricture rests on reduction in the size of the catheter passable or in absolute impermeability to these instruments, and on pain, blood and discharge related with exploration.

**Treatment.**—Ureteral stricture has indications along the same lines as those of mechanical and inflammatory ureteral obstruction and dilatation and lithic ureteral obstruction, and is accordingly discussed under these headings.

### URETERAL OBSTRUCTION AND DILATATION.

**Causes.**—Obstruction and its sequel, dilatation of the ureter, are considered together for the reason that the latter hardly ever occurs without the former. It might be well to consider these subjects with pictures, were it not for the fact that obstruction may exist without picture of the ureter itself.

The common factors of ureteral obstruction and dilatation are infection, urethral, prostatic, vesical, uterine, vascular, inflammatory, lithic and paralytic.

**Mechanical Ureteral Obstruction and Dilatation.—Varieties and Clinical Features.**—Urethral stricture, prostatic hypertrophy, and vesical neoplasm simply by the hydraulics of back pressure of urine impeded in outlet, set up progressively, hypertrophy, dilatation and chronic inflammation of the ureter. The urinary discharge is strong as long as the muscular coat is healthy, and weak when the stage of atony appears.

Pressure of the gravid uterus acts directly on the ureter as it does on the vasa and induces obstruction. The urinary discharge is feeble in the marked cases only. Its frequency is normal, as there is no alteration in the nervous or muscular mechanism.

The sequel is hydronephrosis, and later, with infection, pyelitis. The diagnosis is by catheterization which usually evacuates a copious steady flow of urine in drops like a hydronephrosis, normal and clear, unless pyelitis has supervened.

Aberrant renal and lumbar arteries may cross and constrict the ureter, resulting in the vascular forms of ureteral obstruction. The degree is usually moderate and the symptoms slight. The diagnosis rests on a dilatable evenly passable obstruction with little discomfort

to the patient and with marked relief of dilatation of the renal pelvis if present through the steady rapid dropping of the urine.

**Treatment.**—Mechanical ureteral obstruction and dilatation demand first, the removal of the cause, and second, the relief of the lesion in the ureter if persistent, after the cause has been remedied. The steps of this procedure are the same as those discussed under treatment of lithic ureteral obstruction.

**Inflammatory Ureteral Obstruction and Dilatation.**—**Location.**—Inflammatory ureteral obstruction may be located within and without the canal at any point. The intrapelvic segment of the ureter is more or less associated with lesions of the bladder about the meatus while the suprapelvic or upper two-thirds of the ureter may be diseased with little or no effect on the bladder. Tuberculosis causes multiple constrictions, dilatations, ulcerations and similar lesions in the ureter as elsewhere, and is the commonest source of inflammatory obstruction. Foreign bodies, namely, calculi, are identified with stricture and dilatation, and are considered under the subsequent heading of lithic obstruction.

The exudate varies with the degree of inflammation. The commonest organisms are *Bacillus tuberculosis* and *Bacillus coli communis*.

Ureteral catheterism and all its modern adjuvants are often required for final diagnosis.

**Lithic Ureteral Obstruction and Dilatation.**—**Varieties and significance** of lithic ureteral obstruction are formative, migratory and impacted. The significance of stone in the ureter is the fact and degree of the obstruction and the effect on the ureter at, above and below the point of impaction and on the kidney.

**Cause.**—*Formative or native ureteral calculi* are the product of chronic inflammation associated with other sources of obstruction, but are relatively much less frequent than the other two forms.

*Migratory ureteral calculi* are of renal and pelvic origin. Small stones of this class pass throughout the ureter into the bladder with few but severe symptoms of colic. Their arrest is temporary at one of the normal constrictions of the ureter. Occasionally they are returned into the pelvis of the kidney from the narrowing just distal to it, but more commonly they slowly descend into the bladder where the cystoscopist may discover them, or are evacuated with the urine. Thus, such stones are not very commonly under cystoscopic examination.

*Impacted ureteral calculi* are capable of no further descent beyond their point of fixation. By far the most numerous are arrested migratory stones from the kidney and pelvis above, while a few are formative, due to local ureteral disease. About 30 per cent. of these stones are impacted in the proximal third of the ureter, just distal to the pelvis, about 15 per cent. in the middle third, just proximal to the brim of the bony pelvis in the region of the common iliac vessels, while 55 per cent. are in the distal or vesical third of the ureter, especially in the region of the outlet where the ureter pierces the bladder.



**Chemical Composition of Calculi.**—Ureteral obstruction is the same in the concretions and compositions as those found in vesical and ureteral calculi, namely, uric acid and oxalates in most primary cases, phosphates in the majority of secondary cases. Compound stones are and in which a uric acid nucleus, after infection, receives a deposit of phosphates of the pelvis with decomposition of urine.

*Uric acid calculi* occur in acid urine, often associated with uric acid and urate crystals. They are commonly brown with red or yellow tone. They are somewhat apt to be small and faceted because multiple, harder than soft, ovoid or spheroid, rough and irritating. They commonly form the centers of compound stone with phosphates and other secondary deposits upon them. They are the most common stones in the so-called primary nephrolithiasis.

*Oxalate of lime stones* also occur in acid urine, are brown or blackish, darker than the uric acid calculi, very rough, hardly ever smooth, constituting the so-called mulberry calculus. The urine commonly contains oxalate crystals. Oxalate stones appear in secondary cases as a rule.

*Cystin stones* are very rare and occur only in acid urine.

*Phosphatic stones* are the rule in alkaline urine, less so in acid urine, are commonly white, spheroid, larger than the others because more slowly formed, rough but less so than the oxalates. The urine is very rich in phosphatic detritus.

**Sequels.**—Sequels of lithic ureteral obstruction arise from the partial or complete closure of the canal, and affect the ureter and the kidneys. On the ureter the conditions at the seat of the stone are chronic inflammation, irritation and ulceration with their essential accompaniments of mucus, pus and blood. The proximal ureter is dilated at first, hypertrophied, later atonied, while the distal portion is congested and like the whole ureter the seat of inflammation.

In the kidney of the same side partial obstruction results in altered function, dilated pelvis and hydronephrosis. Later infection progresses and produces pyonephrosis. Nephritis usually precedent to, is augmented by the stone and its obstruction. Complete obstruction causes anuria, on the affected side, and sometimes in both kidneys, of the uremic and even fatal type.

In the kidney of the opposite side, partial obstruction, especially if progressive, results in compensatory hypertrophy, so that this one kidney may be doing more and more and finally all the urinary excretion. Sudden complete obstruction, as just stated, means anuria and thereafter rapidly developed compensation.

**Diagnosis.**—Lithic ureteral obstruction is finally determined only on the basis of history, urinalysis, physical examination, cystoscopy, ureteral catheterization and x-ray investigation.

The subjective history of ureteral stone is commonly of recurrent attacks, at first slight, and later of slowly progressing intensity, or of abrupt, intense attacks referred to the thighs and genitals, especially the knees. Dull, heavy and indefinite discomfort may precede the attacks



for long periods or alone be present. Stones in the vesical portion of the ureter usually cause severe pollakiuria and symptoms of cystitis. Nausea, shock, chills, fever and prostration accompany extreme cases.

Urinalysis is usually not very satisfactory. It may vary from normal hyperacid urine, with little or no signs of renal or ureteral disease, to acid or alkaline urine, with the signs of pyonephrosis, hydronephrosis, nephritis, ureteritis and the like.

Urinary function is affected little or much according to the severity and the suddenness of the obstruction. Immediate absolute obstruction causes anuria on the affected or both sides. Slow, recurrent obstruction sets up decreasing function on the affected, and increasing excretion on the opposite side. The total output is usually normal even when one kidney has finally passed out of use. Hydronephrosis, while closed, may or may not change the quantity of the urine, according to the validity of the normal kidney; while being relieved there is more or less sudden and free outflow of the urine. Infection and other changes in the various urinary organs accompanying the stone and its obstruction, give characteristic urinary conditions.

Physical examination in lithic ureteral obstruction usually elicits tenderness, pain and increased pus and other urinary sediments. It should include abdominal exploration along the course of the ureter and bimanual, rectal or vaginal examination. The former avails above the brim of the bony pelvis, and the latter below it, so that frequently stones, at or near the bladder wall, may be felt and even delivered into the bladder by these manipulations.

*Cystoscopy.*—Diagnosis of lithic ureteral obstruction usually reveals no cystitis unless the bladder has become secondarily involved, and no material alteration of the meatus if the stone is in the proximal two-thirds of the ureter. If the stone and its obstruction are near the meatus in the vesical third, its pressure excites hyperemia, edema and enlargement, and its consequent inflammation produces mucus, pus and blood.

In the upper and middle thirds of the ureters, at the renal pelvis, and above the bony pelvic brim, ureteral stone causes very few vesical signs and none whatever on which diagnosis may be based. The urine is discharged in small, frequent spurts, past the ball-valve action of the stone. Less than half the stones of the ureter are in these regions.

In the lower vesical third, however, the picture of the ureteric mouth is one of prolapse by inflammation and edema, cystic degeneration by pressure and irregularity and masking of the lips. Hemorrhagic spots and edema are common in the annexa. Acute cases show these conditions which subside with the chronic cases to patulous deformed and contracted mouths and mucopurulent stringy discharge. The inter-ureteric fold and the ureteric folds are prominent, thick, inflamed and sometimes edematous in the acute cases and prominent and thickened in chronic cases.

Lithic ureteral obstruction in the vesical segment, that is, within or near the bladder wall, causes, in acute cases, submucous ecchymosis.

extensive prominent edema, masked prolapsed meatus and similar changes in the ureteric and interureteric folds. Mucus, blood and pus are discharged with the urine usually. In chronic cases the meatus is deformed, contracted and patent and ejects stringy discharge. If the stone presents it appears as a rounded or conical brown to gray button in the meatus. Such a cystoscopic picture, combined with severe paroxysms of pain and pollakiuria, is strongly diagnostic of stone near the outlet of the ureter.

Lithic obstruction of the ureter during progressive descent of the stone gives the same variations in the picture as just described for impaction in various points, but not with sufficient reliability for a fixed diagnosis.

*Ureteral Catheterization.*—The diagnosis of ureteral obstruction should include the use of conical, olivary and flute-end standard ureteral catheters with or without stylets, bismuth and lead x-ray catheters, wax-tipped catheters of Kelly and the wax-tipped whalebone filiform guides of Harris. The stone commonly arrests the catheter or permits it to slide by with sudden jump. Pain and slight bleeding are common through disturbance of the stone in its bed. If the catheter passes and remains unblocked by mucus and pus, a more or less copious evacuation of urine from the dilated ureter and pelvis above follows.

*Radiography.*—Lithic ureteral obstruction demands careful repeated photographs in all cases of doubt or seemingly negative results. No photograph is conclusive unless the shadow of the stone overlies or is in close relation to that of a styleted or a bismuth or lead x-ray catheter, or corresponds with the lower point of the dilatation of pelvis and ureter above the stone revealed by filling these portions with 50 per cent. argyrol solution or collargol. Errors arise from phleboliths and sometimes changes in lymphatic glands near the ureters, particularly below the bony pelvic brim. A precaution is free evacuation of the bowels whose contents may give deceptive shadows.

*Treatment.*—Lithic ureteral obstruction is approached through intravesical and extravesical routes. The extravesical methods are the major operations which should be further mentioned here. The intravesical details include local anesthesia of the ureter and free lubrication by the injection of sterilized olive oil above and below the stone, as a stimulant of peristalsis and an aid of descent. Through the operation cystoscope the ureter should be dilated with ureteral catheters, filiform-tipped dilators or Buerger's ureteral bougies-à-boule with or without the passage of the d'Arsonval electrical current as a preliminary of either the foregoing or the following steps. After widening the canal the stone may be delivered with the aid of vesical forceps, such as Buerger's, through the operation cystoscope, the direct-vision instruments, and in women the endoscopic tubes. The Buerger cystourethroscope might be available in rare cases. Occasionally stones may be delivered by massage through the vagina and rectum.

## URETERAL WOUNDS AND FISTULÆ.

**Occurrence.**—Ureteral wounds occur chiefly as rupture during violent injury of the kidney and punctured and incised wounds completely or incompletely dividing the canal. Fistulæ of the ureter results from such incidents most commonly, and less frequently from sloughing after severe infection, pressure or trauma or other interference with nutrition. Most trauma occurs in men and in the proximal two-thirds of the ureter, associated with renal injury, while operative accidents are more frequent in women and below the pelvic brim where the ureter is in relation with the internal sexual organs.

**Diagnosis.**—Ureteral wounds are recognized at the time of operation for injury of the kidney, or of operation for other purposes. In both cases by the appearance of urine in the field in the region of the ureter. Fistulæ of the ureter are determined by a history of extensive intervention for cancer, tubal and uterine disease, followed by incessant discharge of urine beginning during the first few hours after the operation or several days later, if gangrene has been an element. Diagnosis of the fistulous outlet rests on the point of its discharge—abdominal, vaginal, uterine, intestinal or rectal. Constant leakage from the urethra may mean temporary paresis or permanent paralysis of that canal and not damage to the ureters. Dyes, such as indigocarmine and methylene blue, injected into the circulation will show on the dressing in a few moments, namely, high or low in the vagina, according to the point of outlet, or on any other surgical dressing wherever placed. If this test is watched, the dressing may be removed and the discharge of dye seen at the mouth of the fistula before its annexa are stained, and thus hide the exact point.

*Cystoscopy* will, in recent cases with partial division of the ureter only, reveal little change or only a reddening of the meatus and annexa in wounds of low situation. Complete division of the ureter may or may not show cessation of muscular action, precisely as in some cases of nephrectomy when the nerve supply of the ureter has not been damaged. No urine escapes from such cases while much or little flows when the division is incomplete.

*Ureteral catheterism* is hazardous in recent cases, especially of suspected rupture, and is rarely done excepting with the greatest gentleness and caution. In older cases the catheter will be obstructed by infiltration about the point of injury.

**Treatment.**—Wounds of the ureter during operation may often be primarily sutured, or if this is impossible, the proximal end may be implanted into the summit of the bladder. A fistulous tract may often be made to heal by applications to its mouth, especially if the opening is very near the bladder into the vagina. The kidney in old fistulæ is often infected and indicates nephrectomy. Preventives of infection of the kidney are the regular use of antiseptics, internally for the urine, and externally for the outlet of the fistula in the vagina or on the skin.



## FUNCTIONAL CAPACITY OF THE KIDNEYS.

**Importance of Determination of Renal Function.**—The knowledge gained from functional renal tests is the basis of all surgical intervention and of selection of cases in such a manner as to make operative statistics much more reliable, judicial and fair. Unless the study of the renal reserve force shows that one kidney is reasonably capable of carrying on the body function, its diseased fellow cannot be wisely interfered with in material degree.

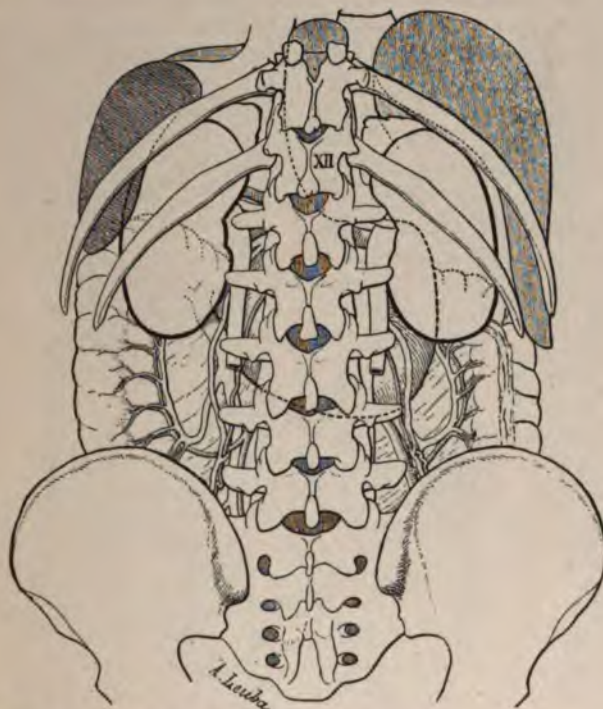


FIG. 282.—Posterior surface of the kidneys. (Poirier and Charpy.)

The object, therefore, of functional kidney tests is to indicate the degree of destruction of the kidney function on the diseased, or relatively diseased side, as compared with the capacity of the kidney on the normal or relatively normal side.

Older methods of renal investigation are chiefly embodied in urinalysis, physical, chemical, microscopical and bacteriological, with little distinctive accuracy, however, because the urines from both kidneys are mixed in the bladder, and disease of the bladder and urethra directly and commonly, and disease of the prostate, uterus and vagina indirectly and less commonly, confuse the deductions.

Polyuria of reflex origin increases the quantity and transparency of the urine but decreases the specific gravity, color, percentage of urea

and of other important salts and proportionally the microscopic elements.

Reflex oliguria reverses all these conditions and thus, also, is a source of error.

Urea determination alone may not be relied on because its percentage varies in health with diet, exercise and other factors. Even with ureteral catheterism it is uncertain because leakage around the catheter is a serious difficulty and indicates the necessity of always using full size catheters.

Urinary salts other than urea, such as the chlorides and phosphates, vary with diet, exercise, nervous and other states, and are in themselves not very stable chemically, and hence cannot be relied on as indices of renal power.

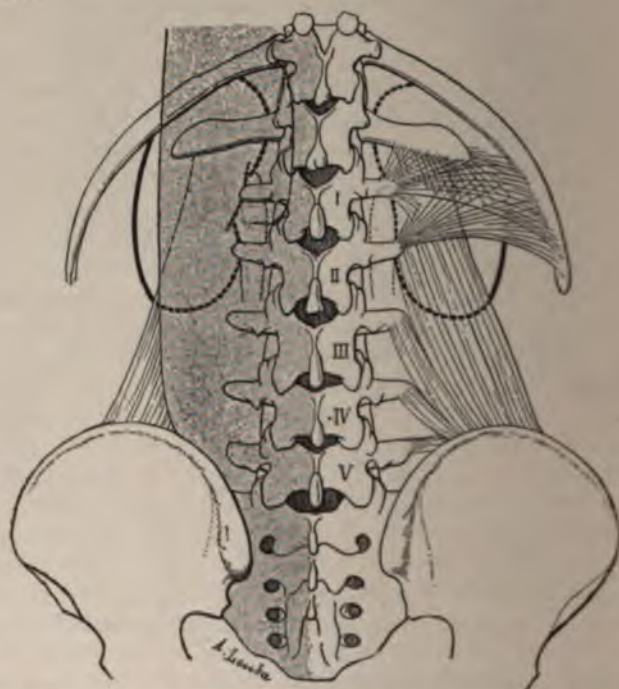


FIG. 283.—Relation of the kidney to the vertebral column, ribs, muscles, and lumbo-costal ligaments. (Poirier and Charpy.)

Albumin content of the urine has important varieties from other than the kidney sources, such as the prostate. Such a factor must first of all be determined. The overstrained normal kidney doing the duty of its failing or failed fellow, may have the albuminuria of congestion and intoxication, which disappears after the diseased kidney with its toxic effects is removed. Albuminuria also varies with diet, exercise, all toxic and absorptive states, and therefore does not finally denote renal, especially surgical renal lesions.



Microscopic, especially epithelial, elements in the urine vary during the exacerbations of chronic renal conditions, and appear to be due largely to congestion of the better kidney. Pilcher has determined this by actual ureteral catheterism to the degree that sediment of renal epithelia somewhat resembles pus in the test-glass. Such increased microscopical findings disappear after a nephrectomy.

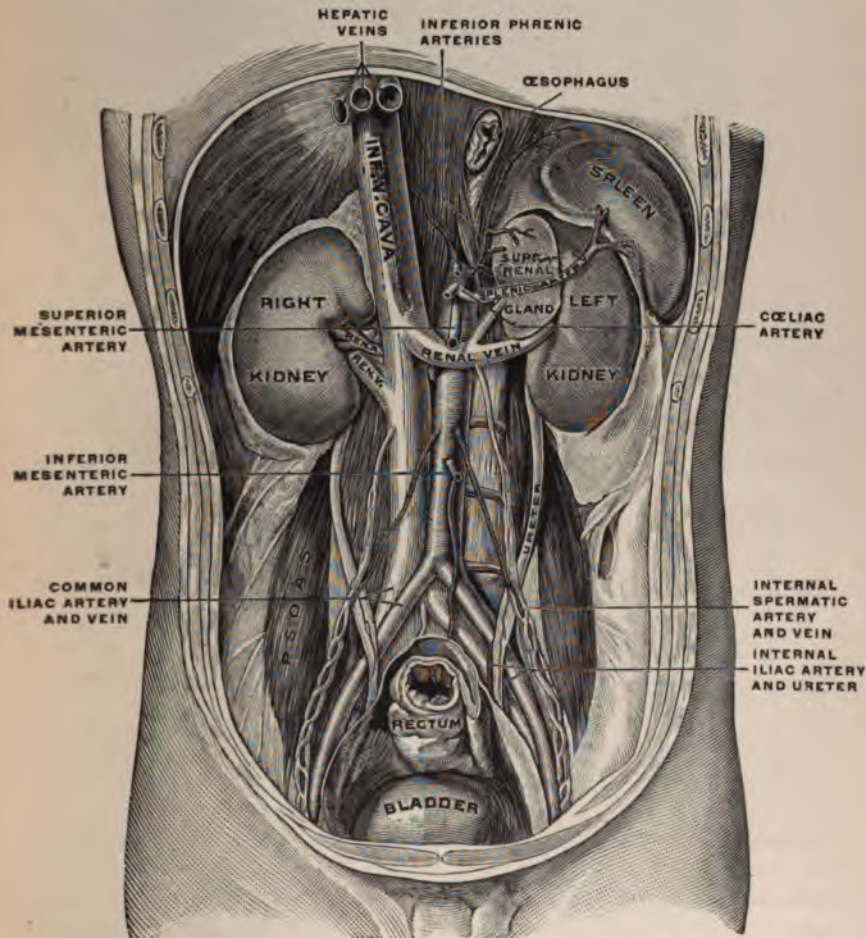


FIG. 284.—Posterior abdominal wall, after removal of the peritoneum, showing kidneys, suprarenal capsules, and great vessels. (Corning.)

It will readily be noted that all the foregoing established means of investigating the kidneys have their value but are not final in their results, being really contributory and corroborative evidence.

Ureteral catheterism has with absolute finality shown the difference between the urines in the bladder and from the individual kidneys. Vesical urine is necessarily affected by disease there, whereas the urine



through the ureteral catheter is affected chiefly in quantity by leak and reflex polyuria or oliguria—all more or less surmountable difficulties, as compared with the masking of the observation through urine from a cystitis as well as a renal lesion.

Urethroscopy is valuable for clearing up the source of pus and blood, for examples, in cases where the upper urinary tract is shown to be free of disease.

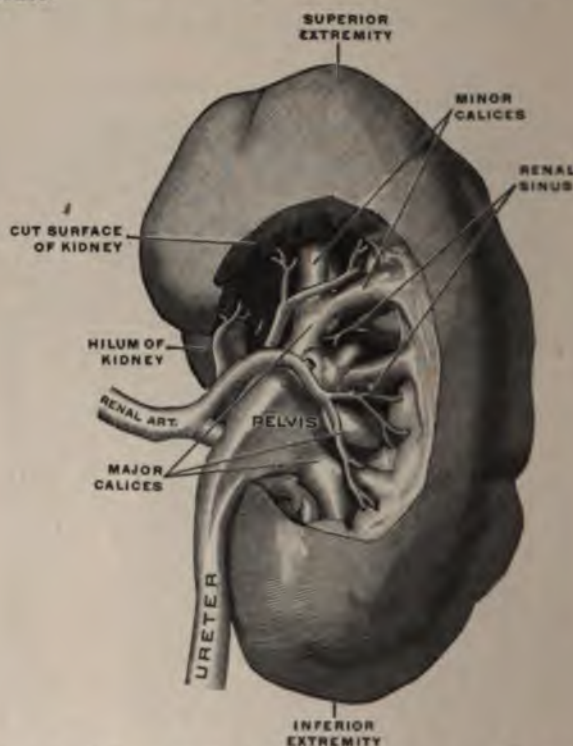


FIG. 285.—The right kidney with the pelvis of the ureter exposed, and showing a branch of the renal artery, viewed from behind. (Spalteholz.)

**Advanced Functional Renal Diagnosis** includes the following methods in ascending order of merit in the present state of knowledge: urinalysis, measurement of conductivity to electrical current, cryoscopy of blood and urine, chromocystoscopy, artificial polyuria, artificial glycosuria and phenolsulphonphthalein excretion. Other than the last test, observation as to the excretion of other substances have been made but discarded as misleading, examples are among drugs, salicylic acid and iodid potash, and among dyestuffs methylene blue and fuchsin. No reliance may be placed on experimental glycosuria, the phenolsulphonphthalein test or chromocystoscopy, if interpreted in the light of the older methods, stated in the first part of this chapter.

**Essential Data of Renal Function** include the following facts: that already pointed out, each kidney functionates independently of

ellow in time, rapidity and frequency of action and in the exact quality of the urine; also, that there may be great disease and even destruction of a small portion of one kidney without impairment of its total function; and finally, that the results of each and all the foregoing five



286.—Palpation of the kidney. Position of the hands in Guyon's method. (Legueu.)

hods give corroborative and valuable data for diagnosis in advanced ase of the kidney, but confusing and contradictory data in slight ees of renal lesion. This is due to the slight variations in the tests



G. 287.—Palpation of the kidney. Attitude of patient and position and action of hands in Israel's method. (Legueu.)

hemselves and to the excretion of the elements of the various tests by different parts of the kidney substance. The greatest variation seems to occur between artificial glycosuria and the dye tests. For example, sugar may appear from both kidneys in twenty minutes, the established



normal standard, but a dye like indigocarmine may be much delayed in excretion. Such a circumstance may well be due to the fact that different parts of the kidney excrete chemicals so diverse as indigocarmine and phloridzin.

Urinary electrical conductivity requires expensive, delicate apparatus and difficult technic, but after all, possesses the same physical basis as specific gravity determination. It therefore shows no advantages and is very little used.

**Cryoscopy of Blood and Urine.—Advantages and Disadvantages.**—The advocates of cryoscopy admit that it requires corroboration with other means as a rule. Its physical basis is that of specific gravity and is closely analogous thereto. Alone it has no great advantages over later and more exact tests.

It owes its developments chiefly to European observers. Casper reports that urine of low specific gravity, hence of decreased concentration, occurs in kidney disease which is indicated by a low cryoscopic index. Rupel corroborated this and showed that the greater the disease of the kidney the lower the cryoscopic index of the urine. Kapsammer, noting that polyuria occurs in the healthier kidney and oliguria in the diseased organ, both of reflex origin, found the freezing-point of the polyuric urine lower than that of the oliguric specimen, and thus he established a comparative test for the two kidneys.

The tendency now seems to be to combine and compare cryoscopy of the blood and the urine in each patient. Kummell, for example, says that if the cryoscopic index of the blood is more than  $-0.60^{\circ}\text{C}$ , kidney insufficiency is established and nephrectomy hazardous. Kanyani has shown that the normal hemic cryoscopic index with healthy kidneys is  $-0.56^{\circ}\text{C}$ . The limits of variation in health is only  $-0.01^{\circ}\text{C}$ . Hence it follows that functional disease of the kidney is indicated when the cryoscopic index of the blood is less than  $-0.56^{\circ}\text{C}$ , using distilled water as the standard.

**Principles.**—Essential cryoscopy of blood and urine as in all other functional tests requires knowledge of the quantity of the urine during a definite period and of the presence of nervous and other interfering elements, and judgment, foresight and reason in applying the results of the tests. In a nervous patient a polyuria during a half-hour, for example, 200 c.c. with a consequent low cryoscopic index, or an oliguria of say, 20 c.c., during a half-hour, with a consequent high cryoscopic index, would both be misleading and unfair bases for estimating the functional activity and reserve of the kidneys.

**Apparatus.**—The apparatus of cryoscopy of blood and urine consists of a flat-bottom cylindrical glass jar, filled with the freezing mixture and resting on the usual chemical laboratory standard. Within this is a similar much smaller flat-bottom glass cylinder passed deeply into the freezing mixture and secured in place by one of the brackets of the standard. A third and smaller similar glass tube fits inside of this and is held in position in the same manner and so as to leave an air space between them. A Beckmann thermometer with small fractional graduation

is passed through a cork in the innermost cylinder and supported by a bracket of the standard so that the bulb of the thermometer does not touch any part of the apparatus, otherwise error will result. A platinum wire also passes through the cork as a means of stirring the contents under observation. Unless the stirring is carefully and regularly done, the observation will be worthless.

**Technic.**—Cryoscopy of the blood and urine is founded on comparison between the freezing-points of distilled water, blood and urine.

The freezing-point of distilled water is therefore first determined as control and comparison, during constant gentle stirring as stated, and in the following steps: The temperature falls promptly below the freezing-point, momentarily rests, promptly rises to a higher point where it again briefly rests, and then recedes to the freezing-point of the mixture in the outside cylinder. The graduation reached by the thermometer is read off and recorded as the freezing-point of the distilled water.

After this control observation of the distilled water, the test-tube is emptied and the blood and urine poured into it in turn. The freezing-point of each is thereafter determined in exactly the same manner.

In illustration, if, owing to circumstances, the freezing-point of distilled water is  $4.03^{\circ}\text{C}.$ , and the freezing-point of blood is  $3.45^{\circ}\text{C}.$ , the cryoscopic index of the blood is the difference between these readings, namely  $-0.58^{\circ}\text{C}.$ , or two points below the normal cryoscopic index of blood  $-0.56^{\circ}\text{C}.$  Such a result would indicate renal disturbance or insufficiency in virtue of Koranyi's observation that in health the variation is only as little as  $-0.01^{\circ}\text{C}.$

The freezing-point of the urine varies from  $-0.9^{\circ}\text{C}.$  to  $-2.9^{\circ}\text{C}.$ , according to concentration or specific gravity, again using distilled water as the standard of the cryoscopic index. Kummell claims that a reading below  $-0.9^{\circ}\text{C}.$  shows diseased or insufficient kidneys.

**Sources of Error.**—Deductions from cryoscopy of blood and urine may be affected by renal lithiasis both impacted and migratory, especially the latter during colic, and by pressure of abdominal tumors and pregnancy. Anemia and prostration even without renal disease may lower the cryoscopic index several points, even to  $-0.53^{\circ}\text{C}.$  A lowered relative cryoscopic index, especially to the limit of  $-0.60^{\circ}\text{C}.$ , regarded as the extreme, indicates renal insufficiency estimated in its degree by the amount of change below the normal index  $-0.56^{\circ}\text{C}.$

**Artificial Polyuria.**—**Physical Basis.**—This test was originated and fully developed by Albarran, who was associated with and followed by other European observers. Albarran found that the drinking of a large amount of water increased the quantity of the urine and changed its quality, both over a short period of time. The actual work thrown upon the kidneys is therefore increased and the normal or less diseased kidney meets this emergency while the more diseased or destroyed kidney fails more or less fully. In other words, the normal kidney possesses reserve force of rather wide limits so that it may accommodate itself to the increased fluid and the consequent strain. Manifestly if



both kidneys are diseased, the response to the test is no polyuria, or too little to be reliable.

Albarran<sup>1</sup> and Guyon<sup>2</sup> have proved that the diseased kidney has in most circumstances a constant output of water and urea, while the normal kidney shows the usual variations due to diet, water drinking, exercise and the like, and hence a capacity of response to the polyuria test.

**Essential Elements.**—Functional renal capacity in the polyuric test takes specimens of urine excreted in definite periods of time, observations are made as to the amount of the urine, the percentage of urea or its total, total nitrogen output, sodium chlorid content, cryoscopic index, artificial glycosuria and microscopic elements.

The more copious the polyuria the greater will be the changes in the percentages without necessarily changes in the totals. The tendency is, therefore, to make these observations in terms of the total output of each kidney.

**Technic.**—During experimental polyuria bodily and renal rest are secured by having the patient in bed and withdrawing food and drink for several hours previous to the test. The patient is then given 500 c.c. of mineral or plain water at one drinking, if possible, otherwise at several at very close intervals. The bladder having been previously prepared for cystoscopy, the ureters are catheterized and then counting from the time when the 500 c.c. of water have been taken, three specimens of urine from each kidney are secured, namely, one each at the end of the first, second and third half-hour. All these specimens are examined for the foregoing elements.

The polyuria or quantity curve of the urine varies between the healthy and the diseased kidneys, as already pointed out. The normal kidney increases its output, as a rule beginning with the end of the first half-hour, continues the increment rather regularly during the second and third periods, reaching the maximum in the third half-hour, and then a decrease sets in during the fourth half-hour, when the starting-point is usually reached. The percentage of urea usually falls proportionally with the degree of the polyuria while the total quantity of urea or of nitrogen may remain constant or even increase. The cryoscopic index also approaches the freezing-point of distilled water proportionally with the polyuria and similarly the relative number of microscopic elements changed.

The diseased kidney shows little change in the various elements of the determination and no real curve of polyuria, both the quantity of the urine and the percentage of the urea remaining constant as a rule, thus indicating that the kidney is already working up to its limit and can assume no more burden.

<sup>1</sup> Congrès Internat. de Madrid, 1903 (according to the transactions this paper was never handed in); *Ann. des Maladies des Organes Genitourinaires*, 1903, xxi, 1741; also *Exploration des Fonctions Rénales*, Paris, 1905 (Chapter XII discusses experimental polyuria).

<sup>2</sup> *Assn. française d'urolog.*, October, 1897.

Comparative charts of these facts were prepared by Keyes, who has proved that normal kidneys in the same individual show similar and parallel curves and values of efficiency, and that these indices may vary from the first determination at a second examination but always more or less in parallel degrees.

Charts comparing normal and diseased kidneys show a more or less constant unchanging curve for the affected side but a wide curve for the normal side.

**Results and Deductions.**—From experimental polyuria it therefore follows that when the percentage of urea and similar elements varies little or increases for either or both kidneys, the test is negative and unsatisfactory. Leakage around the ureteral catheters is important and may be provided for by using the largest size of instrument acceptable and those with open ends in preference to conical or olivary tips. Albarran has suggested injecting methylene blue through the catheter to prove the presence or absence of leakage.

Reflex polyuria and oliguria are a source of uncertainty in the test, the former leading to increased urine and decreased percentage of urea as a rule, and the latter, to the reverse states. Occasionally the quantity of urine remains the same and the urea is increased. These facts render corroboration by other tests necessary.

Maximum polyuria is reached during the third half-hour and is therefore the best period of observation, yet it is well to examine all three specimens in order to show the regularity of increase in the various details through the three half-hour intervals. As stated, the normal kidney takes up its added burden regularly. The diseased kidney, on the other hand, shows little or irregular or no increase in urine, and an unchanged percentage in the urea and other elements.

Bilateral renal lesions bring in another factor of uncertainty and require study of the case through other means for elucidation.

**Advantages and Disadvantages.**—The advantages of artificial polyuria are that the investigation of the several urinary contents permits contemporaneous correlation and comparison thereof, chiefly the quantity of urine, the percentage of urea, total urea and nitrogen, glycosuria, cryoscopic index, and estimates, in short, the reserve force of the kidneys under the polyuria test.

The disadvantages of this test are its duration through one and a half hours in wearying the patient and the frequency with which reflex polyuria and oliguria and bilateral disease renders the interpretation of the findings most difficult.

**Temporary Artificial Glycosuria.—Physical Basis.**—The phloridzin test has proved that the intramuscular or subcutaneous injection of the glycosid phloridzin produces a temporary glycosuria whose measure in time of appearance and in degree of excretion is the basis of the test. It is not known whether the glucosid is excreted by the tubules or glomeruli of the kidney and thus the test is of no value in distinguishing the variety of nephritis present. A small dose only is administered, in order not to risk irritation of the kidney. Separation



of the urine from the two kidneys by ureteral catheterism is an essential detail of the test.

Kapsammer's<sup>1</sup> method regards the time of appearance of the sugar in the urine and is based on the fact that diseased kidneys delay the excretion at least a half-hour. This test is therefore only qualitative.

Casper's<sup>2</sup> method prefers the quantitative determination of the excretion of sugar in a definite period of time and recognizes the fact that diseased kidneys excrete much less than normal ones in the same lapse of time. By taking specimens every five minutes and subjecting them to quantitative analysis, both Kapsammer's and Casper's methods may be combined in mutual corroboration.

**Technic.**—The phloridzin test requires a sterile 1 per cent. solution of the glucosid in distilled water and is preferred to an alcoholic solution by most observers. One gramme of phloridzin is dissolved in 100 c.c. of distilled water, so that 1 c.c. of the solution will administer 0.01 gramme of the glucosid, regarded as the standard dose. A smaller proportional quantity may be prepared if desired. Sterilization is secured by using freshly distilled water and by bringing the solution to a boil but never to active boiling, and loss of the phloridzin in the syringe is provided for by administering the solution warm, as precipitation and adhesion to the glass occur on cooling. The 1 c.c. graduated hypodermic syringe of the author is very serviceable for this purpose inasmuch as it permits fractional doses in tenths if elected.

**Kapsammer's Phloridzin Technic.**—The drug is injected, the ureters catheterized, separate specimens are taken, and at the end of ten minutes a qualitative analysis for sugar is made. Separate specimens are taken thereafter every five minutes, ending, as a rule, with thirty minutes, and thus making a total of five specimens. Each is analyzed for sugar. Negative results during the first half-hour require continuation during a second half-hour.

Normal kidneys usually begin to excrete sugar in from ten to fifteen minutes but may exceptionally delay for thirty minutes.

Diseased kidneys are, as a rule, very much slower than these limits, so that a negative result at thirty minutes is regarded as strongly suggestive of functional incapacity, and still longer delay is still greater evidence.

**Casper's Phloridzin Test.**—The glycosid in exact dose is injected, the ureters are catheterized, and separate specimens are taken during definite periods, for example, every quarter hour or half-hour, securing one or several specimens from each kidney. These are analyzed quantitatively for sugar and the total output is the index of the renal function.

As previously stated, by using the same number of specimens and intervals of time, Casper's method may be combined with Kapsammer's, doubtless with advantage.

<sup>1</sup> Nierendiagnostik und Nierenchirurgie, 1907, T. p. 87.

<sup>2</sup> Functional Diagnosis of Kidney Disease, Am. Ed., 1903, p. 58.

**Results and Deductions.**—The phloridzin test determines that slow or efficient excretion indicates incapable kidneys and danger in the operation. There are several anomalous reactions to this test by normal kidneys so that it is best to corroborate it when possible.

Beer<sup>1</sup> has shown that in this functional test the diseased kidney has an influence on the normal kidney, causing either inhibition or stimulation. Thus both negative and positive results may be misleading inasmuch as this influence disappears when the diseased organ is removed, and, for example, a kidney seemingly insufficient resumes full function including excretion of sugar in the phloridzin test. It is not possible to say whether toxic or reflex factors or both combined are at work.

**Chromocystoscopy (Indigocarmine Test).**—**Physical Basis.**—The indigocarmine test or chromocystoscopy, which is the other term applied to this test, rests on the hypodermic or intramuscular injection of 0.16 gramme of indigocarmine (carminum coeruleum). Through the cystoscope the time of excretion of this dye is noted and so far as possible its intensity between the two kidneys estimated. At times, therefore, ureteral catheterization may be avoided, but for accurate comparison had best be carried out. The intensity of the dye is sometimes altered by the reaction of the urine, especially if acid. It is therefore well to try the effect of alkalinizing the specimens.

**Technic.**—The indigocarmine test requires a powder or tablet containing 0.16 gramme of the dye which is dissolved in 10 c.c. of freshly distilled water and brought to a boil but not to actual boiling for sterilization. Subcutaneous or intramuscular injection is made of a definite portion of this solution in accordance with the intensity of the test desired. Excretion begins promptly and continues for twenty-four hours.

In healthy kidneys the dye usually appears in from ten to twelve minutes, although the time and intensity may vary a little between the two sides. For exact determination, therefore, the writer prefers to catheterize the ureters.

In diseased kidneys the excretion of the dye is usually delayed in more or less proportion with the degree or extent of the lesion. This fact is another reason for catheterizing the ureters, because the normal kidney may excrete the dye so rapidly and intensely as to obscure the cystoscopic examination of the time and degree of the excretion from the diseased side.

Kapsammer<sup>2</sup> regards the time of appearance of the dye as important in estimating the functional capacity of the kidneys precisely as he does in the phloridzin test. It is better, however, to combine both the qualitative and the quantitative methods in all these tests when possible, hence the intensity of the color should be studied and regarded.

Kapsammer found that in properly functioning kidneys the blue color appears in ten or twelve minutes. If instead of blue, a green color

<sup>1</sup> Jour. Am. Med. Assn., 1908, 1, 1972.

<sup>2</sup> Nierendiagnostik und Nierenchirurgie, 1907, i, 78.

appears, functional disturbance is indicated. The later the appearance of the color the more serious the state of the kidneys. With normal function the elimination lasts on an average twenty-four hours. He injects 0.16 gramme into the quadriceps a hand's breath above the knee. The author would add that in normal kidneys a green color is often seen when the urine has a deep yellow or orange color, because blue when mixed with yellow or orange produces green.

In the United States valuable work has been done in this field by Thomas,<sup>1</sup> Beer<sup>2</sup> and Furniss.<sup>3</sup>

**Advantages.**—The indigocarmine test concerns chiefly time-saving, inasmuch as this is one of the most prompt methods. Its simplicity in requiring only a cystoscopy is a factor, but, as pointed out, ureteral catheterization adds to its accuracy.

**Phenolsulphonephthalein Test.—Physical Basis.**—The phenolsulphonephthalein test is performed by subcutaneous, intramuscular or intravenous injection of 0.006 gramme of this dye which is followed by its excretion almost totally in the kidney. The test includes observation of the time of its first appearance and computation of the amount passed in two or more definite periods, usually one hour or thirty minutes each. It therefore combines the time—element of chromocystoscopy and the time and quantitative elements of the phloridzin tests. By healthy kidneys from 40 per cent. to 60 per cent. are excreted during the first hour and from 20 per cent. to 25 per cent. during the second hour after the injection. The time of the first appearance of the dye is with healthy kidneys from five to ten minutes after subcutaneous or intramuscular injection, and from two to five minutes after intravenous administration.

The test was developed and described by Rowntree and Geraghty in 1910 and is, therefore, one of the newest functional tests.

**Advantages and Disadvantages.**—The advantages usually acknowledged are: no pain, no danger, sterilization by active boiling, absolute identity by its color even in a drop of urine, fixation of its time of appearance even in minute traces in the urine, and exact quantitative analysis of its excretion, which commonly steadily increases to the maximum during the first half-hour.

Its advantages as laid down by Rowntree and Geraghty<sup>4</sup> may be summarized as follows:

1. As to the kidneys—total excretion of the dye without chemical change, rapid elimination making the brevity of the test an advantage in severe cases, absolute nontoxicity to the patient or the kidneys, absolute nonirritation to the skin, muscle, vein or kidney and small dose with necessarily less likelihood of renal disturbance.

2. As to the test itself—early appearance of the dye in the urine, unmistakable color in alkalized urine, comparative independence of

<sup>1</sup> Jour. Am. Med. Assn., 1913, lx, 185.

<sup>2</sup> Ann. Surg., 1906, xlv, 553.

<sup>3</sup> Surg., Gynec. and Obst., 1913, xvi, 568.

<sup>4</sup> Arch. Int. Med., 1912, ix, 284. Geraghty: Jour. Am. Med. Assn., 1913, lx, 191. Geraghty, Rowntree and Cory: Ann. Surg., 1913, lviii, 800.

this color of effects from urinary pigments, ready and positive colorimetry for quantitative determination through this positive color tone with consequent easy laboratory technic.

The chief disadvantage of the phenolsulphonephthalein test is, after all, trivial. Acid urine gives a deep canary yellow and must be alkalized in order to bring out the true tone of the phthalein. Ammoniacal urine must first be acidified with hydrochloric acid and then alkalized; as in ammoniacal specimens a peculiar brick-red color results.

**Technic.**—The phenolsulphonephthalein test. Stimulation of the kidneys is secured by giving the patient 250 to 500 c.c. of water to drink from fifteen to thirty minutes before the injection, then 1 c.c. of the solution of the dye, containing 0.006 gramme, is injected preferably intravenously, otherwise subcutaneously or intramuscularly. Very convenient ampoules are now on the market containing a little over 1 c.c. of the correct solution of the dye so that very exact and sterile dose is secured. Ureteral catheterism must be performed in every case, but if the intravenous route is chosen it must precede the injection because the dye usually appears in less than five minutes, which might not be enough for the catheterization, which the writer, however, prefers to do first in all cases.

A bottle for the urine from each kidney, containing 2 c.c. of 25 per cent. sodium hydrate solution, is placed with the catheter in it. When the dye appears it diffuses itself rapidly through the fluid so that the observer must be careful to note the pale pink color of the first drop. The time of the appearance of the first drop is important and the difference between the two sides should be recorded. Good kidneys usually excrete within ten minutes after subcutaneous and intramuscular injection and within five minutes after intravenous injection. The longer the delay and the greater the difference between the two sides in time are the first indexes of insufficiency.

For quantitative determination, two specimens are taken, originally at one hour each, more recently a half-hour each, as the maximum output is reached during the first half-hour.

The colorimetry is proceeded with as follows: A cubic centimeter of the dye is raised to 1000 c.c. in alkalized distilled water and a definite volume of this control or comparison fluid is taken as a standard in a special container of the various instruments. With this is compared a definite volume of the urine, also alkalized and raised to 1000 c.c. distilled water.

If the volume of the urine is so small that this step will dilute the color beyond the limits of accurate reading, the writer<sup>1</sup> raises the urine to the nearest volume which is divisible an even number of times into 1000, for example, 100. The quantitative determination in this concentrated solution is, in this example, therefore, ten times its proper amount. The reading should therefore be divided by the factor representing the number of times which the subdilution is contained into 1000.

<sup>1</sup> V. C. Pedersen: *Tr. Am. Urol. Assn.*, 1915, ix, 374.

Another correction of the determination must be made for subdivision of the specimens into equal parts for other analyses in corroboration of this test. If, therefore, such halving has been made, the

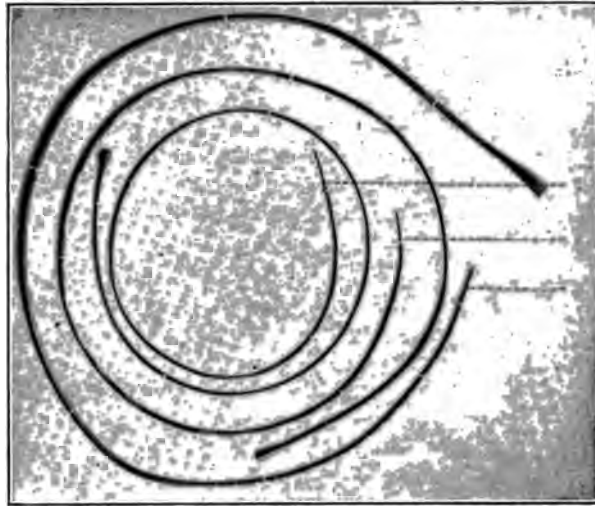


FIG. 288.—Dilating catheters to prevent leakage into the bladder.



FIG. 289.—Subdivision, in the bottle, and subdilution in the smaller graduate.



resulting reading must be multiplied by two, inasmuch as the total output in the given period of time is contained in the whole and not half of the specimen.

Another caution of the determination is the observation of loss during the injection. A cubic centimeter of the solution as furnished in the market is 16+ minims. A loss, therefore, of one drop in blowing out the air-bubble from the hypodermatic syringe would indicate a loss of fully 6 per cent. of the dye injected. This may be compensated for either by arithmetical computation or by making up the test solution one drop short of a cubic centimeter. This refinement is necessary in exact observations only. Ordinary care and judgment alone are required for practical results.

*The Duboscq Colorimeter* is the most accurate, expensive, and cumbersome instrument, and for practical purposes gives no advantages over the simpler varieties of instrument. The technic with the Duboscq instrument is as follows, according to the circular of instructions, from which liberal quotations have been made:

*Path of Light Through the Duboscq Instrument.*—The diffused light, ordinary daylight, lamp or a monochromatic burner, after being reflected on to a mirror, is separated into two beams, which penetrate respectively into the two tubes. The right beam is reflected twice in the right half of a prism; penetrating into the eye-piece, it only affects the right half of the field; the left beam exactly similarly affecting only the left side of the field. No bright light is needed; it is sometimes better to place before the mirror a piece of ground glass, such as is supplied with the instrument.

*Instructions for Using the Duboscq Colorimeter.*—This instrument gives relative results. Place standard colored liquid in left tube. Place liquid to be compared in right tube. Now lower the right tube until it reaches what appears to be the most convenient point for estimation, which depends on the color of the liquids, and note the divisions on scale corresponding to the standard liquid. Lower the tubes until they touch the bottom and the verniers mark zero. Look through the eye-piece and move the apparatus until both half fields are equally illuminated, and then move screws until equality of tone is produced. For two liquids the color is inversely proportional to the density of the column of liquid traversed by the light and proportional to the quantity of dissolved matter. For example, suppose a liquid gives a reading of 12<sup>m</sup>5, and the standard is 10<sup>m</sup>, we shall then have the following proportion:

$$\frac{\text{Color of liquid}}{\text{Color of standard}} = \frac{\text{Height of standard}}{\text{Height of liquid}} = \frac{10^m}{12^m5} = 0.8,$$

so the color of the standard being represented by 1, that of the liquid will be 0.8.

To clear the tubes: raise the piston, take out the tube, unscrew the ring, and take off the glass at bottom. The rest can be easily cleansed by means of a fine cloth.



The *Universal Colorimeter* is available for a large variety of medical tests, including the phenolsulphonephthalein quantitative analysis. It is sufficiently accurate, inexpensive and convenient, and portable in an ordinary instrument bag.

It consists of the following parts: a neat wooden box with black face and interior to prevent optical error. In the black face is a small horizontal slit, behind which is a  $45^\circ \times 45^\circ$  prism, which brings the two columns of color from the standard and the test solutions side by side, with a fine line between. On the left of the box is a little slide and cup, which is a segment of a wedge like the standard solution wedge for containing an exact cubic centimeter of the urine. On the right of the box is a little pinion for raising and lowering the wedge of standard solution until it matches the test solution. The back of the box slides up and down by means of a rack which meshes with the pinion. The back is windowed almost from top to bottom with a wide piece of milk-colored glass, in front of which is mounted with suitable retainers above and below a glass wedge for the standard solution, held with its vertical face forward parallel with the vertical face of the cup for the test solution previously noted. On the left of the back is a scale reading from zero to one hundred so placed as to overlap an indicating finger at the top of the box itself. When the finger is at 0, the edge of the wedge is just within or without view, and when at 100 the deepest column of the fluid within it is exactly opposite the prism. A neat cover makes the box contain all the parts.

The universal colorimeter for the phenolsulphonephthalein test is used as follows: The standard solution is made up in the manner previously described and poured into the wedge until completely filled with the smallest possible air-bubble. The urine to be tested is also prepared as detailed and the container filled exactly up to the cubic centimeter mark of the wedge-shaped cup. Both wedge and cup are then mounted in their respective slides and the box is placed with its milk-glass against a strong light. With the pinion the wedge is then raised until the colors in the prism are alike.

The writer finds it convenient to make the determination at the usual reading distance and then at 20 feet, and to shut the eyes and suddenly open them, in order to gain the first color impression as distinguished from one with the eyes more or less tired. The reading on the scale is then taken directly and denotes the quantitative result unless there has been error in the loss of fluid injected or in subdivision or in subdivision of the specimens for other analyses than the phenolsulphonephthalein test, as previously explained.

The method of estimating quantity excreted using the *Hellige Modified Colorimeter* is as follows:

First, fill the wedge-shaped cell with a standard solution, made by diluting exactly 1 cubic centimeter (1 c.c.) of phenolsulphonephthalein solution, from an ampoule, with about 200 c.c. of water, adding 10 c.c. of a 5 per cent. solution of sodium hydroxide, or its equivalent, and sufficient water to measure one liter. Place the filled

the colorimeter. Dilute the specimen to about 200 c.c. with and render alkaline by the addition of 10 c.c. of a 5 per cent. n of sodium hydroxide, then further dilute the alkaline urine sufficient water to make it measure one liter. Enough of this n should be perfectly clarified by filtration, to fill the rectangular the mark that will be found upon it. The cup and contents n placed in the apparatus and the latter manipulated until the as seen through the prism, are identical, when the percentage etion will be directly indicated on the scale.



FIG. 90.—Hellige colorimeter R. and G. modification: *A* is the instrument with its moved. The wedge-shaped cell for the standard solution is shown at the right, the urine is at the left. The ratchet and screw are at the right for elevating the and reading scale is at the left; *B* is the closed instrument and shows the observadown.

fter adding the alkali, the coloration of the specimen is slight, g small excretion of the phthalein, then the dilution should be only to 250 or 500 c.c. and the readings on the scale divided by as the case may be.

*It's Colorimetric Tubes in the Phenolsulphonephthalein Test.*— apparatus suggested for use by Hugh Cabot<sup>1</sup> consists of a series tubes filled with dilutions of the standard solution of phenol-nephthalein. This standard solution is diluted with an equal

<sup>1</sup> Boston Med. and Surg. Jour., October 12, 1911, clxv, No. 15.

volume of water and placed in test-tube marked "50," which, of course, is 50 per cent. strength of the standard solution. The other test-tubes contain, respectively, 45, 40, 35, 30, 25, 20, 15, 10 and 5 per cent. dilutions. When making the test, the specimen to be examined is compared in a test-tube of the size of those containing standard solutions until one is found to match, or nearly so. The test-tube should be as nearly hermetically sealed as possible and considerable free alkali contained in the test solution. An addition of the free alkali is necessary on account of the absorption of carbon dioxide from the air, thereby neutralizing the alkali, resulting in the changing of the color of the solution, unless excess of alkali is present.

In order to check up readings with the universal colorimeter, the writer has modified the Cabot method in the following way: Ordinary 4-drachm homeopathic phials are taken and filled with test solution in percentages of strength graduated from 100 to 10 by tens and then four additional bottles are prepared, namely  $7\frac{1}{2}$ , 5,  $2\frac{1}{2}$  and 1 per cent. When tightly corked this simply prepared series keeps indefinitely and is very convenient for verifying the readings of the wedge in the universal colorimeter, which are not very accurate from 20 per cent. downward.

It is acknowledged that any reading within 5 per cent. may be sufficiently accurate for all clinical purposes. On the other hand, still greater exactness is attained with the foregoing facility, and may in the long run be a decided gain.

*The Dunning Colorimeter.*—This instrument is a modification of Cabot's and is useful for estimating the quantity of phenolsulphonephthalein excreted when applying the Rowntree and Geraghty Renal Functional Test.

To estimate the quantity excreted, using the Dunning colorimeter, dilute the specimen to about 200 c.c. with water and render alkaline by the addition of 10 c.c. of a 5 per cent. solution of sodium hydroxide, then further dilute the alkaline urine with sufficient water to make it measure one liter. Enough of this dilution should be perfectly clarified, by filtration, to fill the open ampoule. This ampoule, containing the specimen, should then be placed in the center hole of the colorimeter box and compared with the sealed and marked test ampoules until the one that most nearly matches the specimen in color is found. From this comparison, the phenolsulphonephthalein content of the specimen may be approximately estimated. More rapid and closer comparisons may be made by using two test ampoules at a time, one on either side of the specimen. The percentage of output between the ampoule numbers may be more closely approximated by this method.

If, after adding the alkali to the specimen, the coloration is slight, showing small excretion of the "phthalein," then the dilution should be carried only to 250 or 500 c.c. and the reading, divided by 4 or 2, as the case may be.

*Author's Chart for the Phenolsulphonephthalein Test.*—In order to combine the phenolsulphonephthalein test with the polyuria test and

with physical, chemical and bacteriological analysis of the specimens, and if desirable, with cryoscopy, the author has prepared the following method and chart, having two sides, respectively for the original record and the résumé.

**PHENOLSULPHONEPHTHALEIN TEST.**

Name

Date

Dr.

Hospital

Provisional Diagnosis:

Final Diagnosis:

Excretion in serviceable kidneys—40% to 60%, 1st hour; 20% to 25%, 2d hour.

Time.	Medication and instrumentation.				Urine.				Food.
	C. C.	S. G.	DYE.	C. C.	S. G.	DYE.			
	Empty Irrig.	Bladder	{ Catheter C. sheath	Distention to	c.c.				
	B. P.								
	Water	c.c.							
	Telescope in								
	R. U. cath. in								
	L. U. cath. in								
	Water	c.c.							
	Water	c.c.							
	I Urine								
	B. P.								
				c.c. dye intravenously (		drops lost).			
	B. P.								
	Water	c.c.							
	Water	c.c.							
	II Urine								
	B. P.								
	Water	c.c.							
	Urine III								
	B. P.								
	Urine IV								
	" V								
	" VI								
	" VII								
	" VIII								

Average Specific Gravity

## RÉSUMÉ

HOUR.	Time. elapsed by periods.	Water during first hour.	Food during 24 hours.	Urine by periods during 24 hours.	DYE.		Blood pressure.
					Inject.	Excret.	
Urine I							
Urine II							
Total							
Urine III							
Total I-III							
Urine IV							
“ III-IV							
“ I-IV							
“ V-VIII							
Grand Total							

REMARKS: (*Readings corrected for errors in scale, loss in injection, subdivisions and subdivisions.*)

Water:	Standard quantity	Food:
Urine	polyuria curve:	
Dye	Max.	Min.
Blood pressure		Decrease

CONCLUSIONS:

It will be noticed that the time column permits one to be as detailed as he desires, even including record for the preparation of the bladder and the insertion and withdrawal of instruments. The distention of the bladder should be known in order to determine leakage around the catheters during the observation.

B.P. is the abbreviation for blood pressure, and should, in the opinion of the writer, be taken before the water drinking and at the time of each specimen of urine. If the water drinking is in divided doses, observations in the blood pressure may be made oftener, if desired. A reading should be taken after the injection of the dye.

The writer is rather convinced that the blood pressure curve follows the polyuria curve and the excretion of the dye. In other words, when the kidneys are reasonably able to perform their functions or when one kidney is so doing, the blood pressure will rise with the drinking of the water and reaching its maximum during the greatest excretion of the

water, decline again when the urinary excretion has ceased to show polyuria. The blood pressure also rises with the injection of the dye and in serviceable kidneys falls as the excretion of the dye does during the second hour. The writer therefore expects to see at the end of the second hour, three things, in serviceable kidneys or kidney, viz., decline of the curve to almost normal or actual normal of polyuria, blood pressure and dye elimination.

It is almost needless to add that these findings are corroborated by the older forms of investigation.

Urine I is taken at the end of fifteen minutes before the polyuria curve ordinarily begins and furnishes a control specimen for the various analyses, and thus will show whether the injection of the dye has disturbed the kidneys.

Urine II is taken at the end of the first half-hour or hour after the injection of the dye in the choice of the operator, and Urine III at the end of the second half-hour or hour, as the case may be.

Inasmuch as 85 per cent. is considered the maximum excretion of the dye, and as frequently even normal kidneys give as little as 60 per cent. in the same period, viz., the first two hours, the writer is rather fond of proceeding as follows, if the condition of the patient and the circumstances of the test permit. The catheters are withdrawn when Urine III is secured, and the bladder is emptied of washings and leakage, whose content of dye is determined and recorded. Specimens of urine are then secured for the balance of the twenty-four hours following the test, as follows:

Urine IV at the end of the eighth hour and Urine V, VI, VII and VIII, respectively, at the end of the twelfth, sixteenth, twentieth and twenty-fourth hour.

The observations of this period of twenty-four hours are when the state of the patient and the limitations of the test permit compared with a twenty-four hour specimen of urine obtained in the usual way, and analyzed, and with another twenty-four hour specimen after injection of the dye but without any vesical instrumentation whatever, excepting very gentle catheterization of the urethra to secure specimens at the foregoing periods.

Thus, in the writer's opinion a thorough investigation of the renal function will be had by the study of three twenty-four hour specimens obtained in the foregoing manner and subjected to all the accepted usual tests. Of course, it is understood that there are many kidney cases of acute character or depreciated condition so that such a test might not be altogether advisable. On the other hand, however, there are very many patients who will be benefited by the rest in bed for three days preparatory to any operation, of which two days are indirectly preparatory to the functional test, during which the simple matter of taking twenty-four hour specimens at first without and then with injection of the dye, is carried out, certainly without any reasonable likelihood of harm.

It is needless to say that such a study of the case is laborious, but it



will yield results if done, as far as possible, in the same condition of diet and rest in bed and other circumstances of the patient.

On the back of the chart is the résumé in the upper half of the sheet, whose columns sufficiently explain themselves. It will be noted that the important specimens, Urines I, II and III form a unit in the résumé, while the remaining specimens, IV to VIII, inclusive, are another unit.

The lower half of the page is set apart for remarks on the observations, corrections and conclusions, and needs no elucidation.

**Sequence, Correlation and Comparison of the Various Functional Tests.**—From what has already been said, the advisability will be seen of analyzing kidney cases in an orderly, systematic, thorough manner. A careful subjective and objective investigation of the case with special stress on a physical examination of the kidney zone must be had first. Then the preliminary of the functional tests is withdrawal of all foods, drinks and drugs for a definite period, usually accepted as six hours. The second step is the preparation of the patient and the bladder for cystoscopy and ureteral catheterism as detailed in previous pages. If, as should be the case, sequence and corroboration of the various functional tests are desired, the best selection in our present knowledge is artificial glycosuria, artificial polyuria, and one of the dye tests, by preference phenolsulphonephthalein.

After the preparation, therefore, the artificial glycosuria test is begun in the manner laid down in previous paragraphs of this chapter. At the end of ten minutes, before sugar ordinarily appears, specimens from each kidney are taken and set aside for the established method of physical, chemical, microscopical and bacteriological analysis. At the end of fifteen minutes and every five minutes thereafter up to the first thirty minutes, specimens are taken to determine the time of the appearance of the sugar after the method of Kapsammer qualitatively, and by preference, also quantitatively, after the method of Casper. If desired, these four five-minute specimens may then be combined and examined exactly like the first for any change in excretion under the influence of instruments and drug. Thus may be diagnosed chronic parenchymatous nephritis by low specific gravity, albumin, casts and slow and low output of the drug. As a rule, further functional test in such kidneys is not worth while. If all five specimens for sugar at the end of the first half-hour are negative, the artificial glycosuria test may be regarded as useless.

Artificial polyuria is the next step. If 500 c.c. of water were given before the glycosuria test was begun, no further drinking will be necessary as the incidence of the polyuria begins at the end of the first half hour and proceeds as already described. Otherwise such a draught of water must now be given and this test carried forward as described.

The phenolsulphonephthalein test is the last of the combination and may be begun at the end of the second half-hour. While the polyuria curve is reaching its maximum during the third half-hour, this dye is also attaining its highest output. If two periods of a half-hour

each are adopted in the phenolsulphonephthalein test, its last period will correspond with the fourth half-hour of the polyuria test and thus the two will reach their decline together and the three tests cover only two hours and a half of time.

Chromocystoscopy or the indigo-carmin test, is only qualitative and therefore not reckoned among the most satisfactory three tests.

This plan of procedure obviously permits in addition to the established analyses, observation of the glycosuric, polyuric and chromic curves in mutual comparison and corroboration.

### CHEMICAL HEMATOLOGY.

**Significance.**—Bilateral or combined renal efficiency is proved by chemical analysis of the blood for retention of urea, uric acid, creatinine, sugar, salts such as chlorids and phosphates and other less important and usual elements. All are increased or varied in degrees proportional with the kidney disease. Bilateral efficiency is usually fully designated in this way, but when cystoscopy and catheterization of the ureters show one kidney to be practically without function, then chemical hematology may be regarded as applying to the active organ.

The purely mathematical formulæ of Ambard<sup>1</sup> and McLean<sup>2</sup> for physiological processes are confusing and unnecessary. Clinical requirements, as demonstrated by Folin,<sup>3</sup> mean simple quantitative analyses for whose laboratory details the reader must consult works on clinical chemistry or clinical diagnosis, but each of the foregoing elements requires individual note.

**Urea in the Blood.**—Urea is largely of exogenous origin and therefore variable with the nitrogenous quality and quantity of food. Its prompt response to changes in diet makes it a good index of the progress and results of treatment.

Its range in health is narrow and between 12 and 15 milligrams per 100 c.c. of blood. Larger quantities are constant and proportional with temporary and permanent disease of the kidneys through decrease of elimination and subsequent accumulation in the blood. Pathological renal conditions show variations between 15 and 50 milligrams per 100 c.c. of blood, and the larger the quantity the more serious the outlook. Widals's<sup>4</sup> teaching is summed up in the thesis of his student Weill<sup>5</sup> in these statistics: Twenty-eight cases with over 300 milligrams of blood urea per 100 c.c. of blood all died in from one week to five months and ten days. Forty-three with blood urea between 200 and 300 milligrams per 100 c.c. of blood all perished between one week and seven months and sixteen days. Hence there is practically no difference between these ranges. Weill gives no corresponding figures for

<sup>1</sup> Compt. rend. Soc. de Biol., 1910, lxix, 411, 506.

<sup>2</sup> Jour. Exp. Med., 1915, xxii, 212, 366; also Jour. Am. Med. Assn., 1916, lxxi, 415.

<sup>3</sup> Jour. Am. Med. Assn., 1917, lxix, 1212.

<sup>4</sup> Quoted by Simon, loc. cit., pp. 104 and 689.

<sup>5</sup> Thèse de Paris, 1913.

100 to 200 milligrams or for less than 100 milligrams. Elsewhere he states that while exceptionally a large quantity like 76 milligrams per 100 c.c. of blood may decrease, as a rule, the content steadily increases, going from 60 to 70 or even 80 milligrams and thereafter to 100 milligrams per 100 c.c. of blood. From 100 to 200 milligrams give a sombre prognosis. With such patients life is rarely more than one year, and between 200 and 300 milligrams it is only months or weeks. Over 300 milligrams are only seen in terminal stages. Still more recently Vidal, Weill and Pasteur Valery-Radot,<sup>1</sup> in discussing stopping places in azotemia in nephritis, make the following statements:

1. Nephritics with azotemia of 100 milligrams of urea to 100 c.c. of blood without retrogression almost always succumb within two years.

2. If the urea is increased but does not reach the limit of 100 milligrams to 100 c.c. of blood, the evolution of the disease cannot be foretold in the same way. A single determination of urea of 100 milligrams in 100 c.c. of blood need not mean anything. This is a corollary of the first observation.

3. Persistent elevation of Ambard's constant, even if the blood urea is normal, may be regarded as a preliminary to azotemia.

4. If 200 milligrams and upward of urea per 100 c.c. of blood are present, death may be expected rather early—the sooner, the higher the figure.

Squier and Myers<sup>2</sup> have observed that among hospital patients over 15 milligrams is common and that quantities above 20 during restricted protein food indicate deficient renal function. In their hands urea has been a more valuable anteoperative prognostic test than any other.

Decrease of renal elimination in interstitial nephritis and in surgical conditions of the kidney is the common cause of retained urea and its increased percentage in the blood. The latter fact determines its value as a test of efficiency. In eclampsia according to Simon<sup>3</sup> fatalities show smaller amounts of urea than recoveries, which indicates both decreased formation and elimination.

**Uric Acid in the Blood.**—Uric acid is allied and cognate to urea in its origin, significance and variations. Its normal range is 2 to 3 milligrams per 100 c.c. of blood, which marks its changes within very narrow limits for health.

By older authorities it is not enumerated as a constituent of normal blood. From this viewpoint blood containing uric acid is not normal and likewise kidneys causing its appearance in the blood are deficient. Hammerstein<sup>4</sup> states the healthy range to be from 1 to 2.25 milligrams per 100 grams of blood. Winterberg<sup>5</sup> gives the average as 0.9 milligrams. The causes of increased percentages are surgical and non-

<sup>1</sup> *La Presse Médicale*, 1918, xxxvi, 261.

<sup>2</sup> *Jour. Urol.*, vol. ii, No. 1.

<sup>3</sup> *Clinical Diagnosis*, 1914, p. 104.

<sup>4</sup> *Physiological Chemistry*, 1914, p. 334.

<sup>5</sup> Quoted by Hammerstein, but cannot be verified in Library of the New York Academy of Medicine.



surgical types of renal lesion. Pneumonia, leukemia, cardiac disease, pleurisy with effusion, emphysema, cyanotic and severe anemic conditions are given in Simon's work as other causes.

**Noncoagulable Nitrogenous Compounds in the Blood.**—Ivar Bangs<sup>1</sup> states that the physiological content of incoagulable proteins is from 20 to 35 milligrams for each 100 grammes of blood.

Farr and Austin<sup>2</sup> found 15 to 43 milligrams per 100 c.c. in various acute and chronic diseases without kidney lesions. The ammonia urea element was 50–60 per cent. of the stated quantities. Cardiovascular disease and chronic nephritis do not alter the nonprotein nitrogen or ammonia urea in amounts and relations, although albumin, casts, edema and altered phenolsulphonephthalein permeability may be present. In chronic nephritis with hypertension, nonprotein nitrogen increases to from 40 to 180 milligrams per 100 c.c. and the percentage of ammonia urea rises. Fluctuations are rapid and wide. Improved symptoms are accompanied by decreases and uremia by increases of nonprotein nitrogen. No constant index of uremic onset is established.

Analogous to urea, uric acid and creatinine, these proteins accumulate in the blood during the types of renal disease stated. Their observation is so difficult and their importance so questioned that quantitative study is infrequent.

**Creatinine in the Blood.**—Creatinine, in contrast with urea, is chiefly of endogenous origin from muscular activity. It therefore may indicate deficiency of the kidneys better than urea does. Its dangerous accumulations appear usually after urea and uric acid have been doubled, possibly because it is more rapidly eliminated. Its variations in health are not wide. Gettler and Baker<sup>3</sup> state that normal blood contains only 0.5 milligrams per 100 c.c. of blood. Other authors give a range as 1 to 2.5 milligrams. Danger is indicated by 3.5 milligrams according to Squier and Myers, in the paper already cited, and fatality by 5 milligrams. Chronic nephritis accumulates 2 to 3 milligrams and uremic nephritis 4 to 35 milligrams. Poor surgical prognosis is usually indicated by elevations of creatinine; but contradictory findings occur. Squier and Myers note a polycystic kidney case having urea nitrogen 75 milligrams and creatinine 8.3 milligrams, with operation, and survival for a year. Campbell<sup>4</sup> reports a bichloride case with creatinine 12.5 milligrams and recovery. Myers and Lough<sup>5</sup> relate 5 milligrams with fatalities in average cases. It is possible creatinine must be interpreted only in its relation to uric acid and urea as prognostic signs.

**Cholesterin in the Blood.**—In the normal blood traces occur. Matthews<sup>6</sup> states on the authority of several chemists that the total

<sup>1</sup> Methode zur Mikrobestimmung einiger Bluthestandtheile, 1916, p. 28.

<sup>2</sup> Jour. Exp. Med., 1913, xviii, 241.

<sup>3</sup> Jour. Biol. Chem., 1916, xxv, 221.

<sup>4</sup> Arch. Int. Med., 1917, xx, 919.

<sup>5</sup> Arch. Int. Med., 1915, xvi, 536.

<sup>6</sup> Physiological Chemistry, 1916, 2d ed., p. 85.

cholesterine content of the human blood serum is from 1.17 to 2.95 milligrams per 100 c.c. of blood. In a blood analysis cholesterine is averaged at 1.238 per 1000. Simon<sup>1</sup> teaches that larger quantities (.478 per cent.) associated with lipemia occur in diabetes and that special biological methods show smaller amounts in tuberculosis and syphilis. In chronic interstitial nephritis it varies from 1.74 to 2.65 milligrams per 100 c.c. of blood sera. In chronic parenchymatous nephritis 5.59 to 10.00 milligrams per 100 c.c. of blood serum occur and it is markedly increased in cases of gall-stones. Cholesterin is, therefore, rather a better index of gall-bladder disease than of nephritis.

BLOOD ANALYSIS							URINE ANALYSIS*							
CASE	DATE	OUTCOME	URIC ACID				REMARKS	BOILING ALBUMIN	SUGAR	ACETONE	DIASTATIC INDEX	MICROSCOPICAL EXAMINATION	REMARKS	
			MG. PER 100	MG. PER 100	MG. PER 100	MG. PER 100								
O'Conner	8/1	DIED	33	132	400	150	RETENTION URIC ACID. PATIENT DIED SAME DAY.	POS	#	NEG	NEG	NEG	Moderate number of coarse granular casts and red blood cells. Occasional leucocytes.	FINDINGS SEVERE
Fischer	8/2		32	86	41	102	High retention indicating probable fatal outcome. Patient died two days after creatinine reached 5.0 mgms. per 100 cc.	POS	#	NEG	NEG	NEG	Moderate number of granular casts and epithelial cells.	Urinary findings indicated some marked renal disturbance, but not same importance as blood findings.
	8/3		39	98	456	105		POS	#	NEG	NEG	NEG		
	8/4	DIED	39	79	447	100		POS	#	NEG	NEG	NEG		
	8/8		45	71	394	105		POS	#	NEG	NEG	NEG	Moderate number of epithelial cells, leucocytes and fairly granular casts.	
	8/11		44	88	24	110		POS	#	NEG	NEG	NEG		
	8/12		55	69	50	104		POS	#	NEG	NEG	NEG		
Huth	8/2		26	96	363	100	Retention of uric acid. Patient recovered although clinical signs seemed bad.	POS	#	+	+	+	Very few granular casts and occasional leucocytes. Left kidney of course is only one.	Remarkable number of casts in left side of urine.
	8/12	DIED	14	33	20	100		POS	#	NEG	NEG	NEG		
Ship	8/3		76	148	61	107	Clinical signs good. Retention high, affecting attention by fatal prognosis. Died one day later.	POS	#	NEG	NEG	NEG	Moderate number of coarse granular casts and epithelial cells. Occasional leucocytes.	
Muich	8/4		19	33	30	100	Observation made when convalescent.	POS	#	NEG	NEG	NEG		

\* Very large amount  
# Moderate amount  
+ Small amount.

\* # Very large amount  
+ Moderate amount  
+ Small amount.

FIG. 291.—(Gradwohl and Schisler.)

**Sugar in the Blood.**—Accumulations of sugar in the blood may precede the excretion of sugar in the urine. The normal range is 0.09 to 0.12 per cent. Pathological variations are 0.16–0.17 in early diabetes and 0.2–0.3 in advanced cases. According to Myers and Bailey,<sup>2</sup> even in the latter, sugar may not be present in the urine. Simon<sup>3</sup> says a positive blood test may occur while sugar is absent in the urine temporarily. In nephritis there is less diastatic excretion in the urine, hence more diastatic activity in the blood, causing the production of sugar. This is a partial but not an absolute explanation. In diabetes, sugar may reach 0.4 per cent. and in diabetic coma it not uncommonly exceeds 1 per cent., associated with pronounced acidosis, which is determined by excess of salts, as explained in the following paragraphs.

<sup>1</sup> Op. cit., p. 110.

<sup>2</sup> Op. cit., p. 103.

<sup>3</sup> Jour. Biol. Chem., 1916, xxiv, 147.



**Salts in the Blood.**—Edema in nephritis is caused at least partially by decreased renal excretion of sodium chlorid and then by its accumulation in the blood and tissues. Acid phosphate of soda is the source of acidity of the urine and when in nephritis it is retained instead of excreted, acidosis of the blood results. Affinity of the blood for carbon dioxide gas among waste products is lowered by this phosphatic acidity, and becomes an indicator of acidosis.

In diabetes it is the relation among the three elements of acidosis, carbon dioxide affinity and anesthetics (especially chloroform and less so, ether) which marks the importance of chemical hematology for

THE CHARACTERISTIC BLOOD PICTURES IN GOUT, DIABETES & NEPHRITIS II				UREA N, URIC ACID, CREATININE & SUGAR.
DISEASE	UREA N MGMS. PER 100 <sup>cc</sup> of BLOOD	URIC ACID	CREATININE	SUGAR PER CENT
NORMAL	12-15	1-3	1-2.5	0.08-0.12
GOUT		35-6		
MILD DIABETES				0.15-0.30
SEVERE DIABETES				0.30-1.10
CHRONIC NEPHRITIS	15-50	1-4	1-3	
UREMIC NEPHRITIS	80-300	4-15	4-34	0.10-0.20
THERMIC FEVER	UREA N 26-89	URIC ACID 6-14	CREATININE 3-6.1	SUGAR 0.15-0.20

FIG. 292.—(Gradwohl and Schisler)

renal insufficiency and operative prognosis. A corollary is the claim of Whitney<sup>1</sup> that acidosis not uncommonly causes death in nephritis rather than uremia.

**RECAPITULATION.**—Gradwohl and Schisler<sup>2</sup> in a study of thermic fever, which they designate as "certain symptom-complexes that are the result of disturbances of heat regulation, primarily from physical causes," tabulate their results with regard to several conditions associated with urinary and hemic changes. The table (Fig. 291), on page 866, epitomizes their results clearly as to special cases and the above table (Fig. 292) correlates their findings in six important diseases associated with alterations of blood and urine.

<sup>1</sup> Arch. Int. Med., 1917, xx, 931.

<sup>2</sup> Am. Jour. Med. Sc., September, 1917, p. 407.



## CHAPTER XVI.

### ACUTE AND CHRONIC SUPPURATIVE INFLAMMATIONS OF THE RENAL PELVIS AND PARENCHYMA.

**Varieties.**—Cystoscopists are directly interested in three forms of acute suppuration of the kidney, namely, pyelitic, infarct and pyelonephritis, the former being usually nonoperative and the latter two almost invariably operative conditions, and they are concerned in one form of chronic renal suppuration, namely, pyonephrosis, which is scarcely distinguishable clinically from its correlatives, renal abscess and suppurative nephritis.

#### CATARRHAL ACUTE PYELONEPHRITIS.

**Catarrhal Acute Pyelitis.**—**Definition.**—Catarrhal acute pyelitis is usually a unilateral, rarely a bilateral, catarrhal inflammation of the mucous membrane of the pelvis of the kidney and has the same characteristics as catarrhal inflammation of any other mucosa in the production of swelling, mucus and pus. It is usually accompanied or preceded by obstruction of the ureter and dilatation of the pelvis, and followed by hyperemia, congestion and enlargement of the kidney. The disease is usually of self-limited type, especially if the obstruction of the ureter is readily corrected by nature or treatment. The parenchyma of the kidney is therefore not infected and rarely affected clinically beyond congestion and possibly histologically, possibly not at all. These facts distinguish it from other suppurative kidney conditions of chronic character, namely—pyonephrosis, which is really a later development of pyelitis, suppurative nephritis, in which the parenchyma is predominantly infected, and suppurative pyelonephritis, in which both pelvis and parenchyma are profoundly involved.

**Etiology and Pathogenesis.**—Pyelitis is either primary or secondary. The primary pyelites arise without definite assignable cause exactly as do catarrhs of the nasal, intestinal and vesical mucosæ, as examples. There are a catarrhal reaction, infection, edema, ureteral obstruction and moderate pelvic dilatation as features, of which the last two are produced by the preceding three factors.

The secondary pyelitis follows a preliminary obstruction to the ureter as in the pressure of pregnancy, distortion of movable kidney, resistance of extraureteral and intraureteral stricture, prostatic enlargement, urethral stricture, and the like. Cystitis may extend its infection along the ureter to the pelvis, and pus foci elsewhere in the body may be the starting-point.

The exciting organism is commonly the *Bacillus coli communis*, usually proceeding from chronic intestinal disorders which in this connection become extremely important.

Predisposing causes as in all catarrhs are: exposures to cold, physical and nervous exhaustion and any factor inducing sudden internal congestion.

**Syndrome and Diagnosis.**—In outline the chief complaints of the patient are as follow: The ureteral obstruction and renal congestion cause pain, sudden and positive in the affected side. The infection and urinary absorption produce chilliness or chill and fever, with a blood analysis far out of proportion with the importance of the disease, the leukocytosis being 12,000 to 15,000 and the polymorphonuclear leukocytes as high as 85 to 90 per cent. or above. Reflex action produces nausea, vomiting, depression, shock and prostration in the system at large, and in the urinary system frequency, urgency, pain and sometimes tenesmus. The catarrhal exudate shows as mucus, pus and renal and pelvic epithelia in the urine.

Physical examination reveals affected kidney, as a rule movable and almost invariably enlarged and tender. The opposite or normal kidney is without physical signs or slightly tender from congestion in the more marked cases. Bilateral cases show duplicate or correlative conditions on the two sides.

*Cystoscopy and ureteral catheterization* alone establish the diagnosis. The cystoscopic findings resemble those in hydronephrosis. The mouth of the ureter on the affected side is prominent and congested, sometimes patulous and delivers pus-laden urine in dribblets and not in orderly spurts.

Ureteral catheterization delivers from the affected kidney a quantity of urine larger than the pelvis normally holds, thus indicating dilatation and residual urine, especially with movable and displaced kidney, and pus in the urine from the catarrhal process. The unaffected kidney shows a urine normal in quantity and in character except for the occasional signs of renal congestion. The sense of having passed an obstruction is sometimes present on the affected side.

**Differential Diagnosis** is based on the following considerations:

Acute invasion, either without preliminary history or with the history of movable kidney, to attract attention to the renal zone.

Marked persistent pain unrelieved by rest and unexcited by motion, localized in the affected kidney region, particularly in the costovertebral angle of the loins.

Chilliness or chill, fever, and other signs of mild infection.

Blood count of acute suppurative process, not uncommonly disproportional with the severity of the lesion.

Pus without blood in the urine.

Tender enlargement of the affected kidney, grafted on a movable kidney or one in its normal position.

Reflex muscular protection of the inflamed organ.

Ureteral catheterization on the diseased side reveals slight obstruc-

tion in the ureter, sensitive pelvis, acid urine laden with pus, pelvic epithelia and pure culture of *Bacilli coli communis* but free from parenchymatous renal involvement; but from the normal kidney unchanged urine or that of slight congestion.

The course is brief, the disease limits itself and has no sequels in the parenchyma if the cause is removed.

**Catarrhal Acute Pyelitis of Pregnancy.—Definition.**—Catarrhal acute pyelitis of pregnancy hardly deserves individual space as the cases of it are so patently duplicates of all other cases of the disease with the sole fact of pregnancy added. Accuracy requires limitation of the term to patients without history of pyelitis previous to the pregnancy.

**Etiology.**—The etiology of catarrhal acute pyelitis of pregnancy is mechanical pressure on the ureter by the gravid womb usually between the third and last month of normal pregnancy. The infecting organism is the *Bacillus coli communis* in pure culture.

**Syndrome, Diagnosis and Differential Diagnosis.**—In catarrhal acute pyelitis these are the same as in other forms of the disease.

Cystoscopy and ureteral catheterization in catarrhal acute pyelitis of pregnancy add only the changed form of the bladder due to the weight of the pregnant womb and sometimes increased difficulty of entering the ureter.

**Treatment.**—The treatment is nonoperative and operative.

The nonoperative measures almost invariably require waiting for the subsidence of the acute stage and the establishment of the quiescent period. Exception to this rule is the case where severe symptoms require relief by entering the pelvis with great gentleness and caution. Evacuation of the pelvis is the first step in all cases and possibly the only detail in the mild cases. Retention of the catheter for drainage of the pelvis for several hours is required by the more severe cases. Lavage of the pelvis after both evacuation and drainage for cleansing with solvents of mucus and pus and for mild sterilization and stimulation with the nonirritating silver salts is the second step in all cases.

Exactly this same plan of treatment is required in the pyelitis of pregnancy.

Operative measures require replacement of prolapsed and movable kidneys and correction of any obvious obstruction only in the very severe cases.

Induction of labor is unnecessary in the catarrhal acute pyelitis of pregnancy unless the fetus is dead and unless the persistence and resistance of the disease to treatment threatens parenchymatous damage of the kidney.

### SUPPURATIVE ACUTE PYELONEPHRITIS.

**Acute Unilateral Septic Infarct of the Kidney.—Definition.**—This disease may be defined as the lodgment of a mass of infective material of hematogenous origin in the parenchyma of one kidney, forming usually multiple infarcts or foci of infection. Subsequent suppuration



**FIG. 293.**—Author's case of septic infarct of the kidney during pregnancy. Shows the inner surface of the kidney with a rather large pyramidal infarct at the border where the surface of the kidney is broken. In the fresh specimen this was almost diagrammatic.



**FIG. 294.**—Septic infarct of the kidney. Outer surface of the specimen, showing foci of infection near the upper pole, not unlike acne pimples on the face, and indicating extension of the process through the formation of adhesions around the lower pole. (Author's case.)

and abscess-formation are frequent and usual but are not absolutely essential to complete the pathology.

Extensive researches into the subject of infarcts of the kidney have been done in this country by Brewer,<sup>1</sup> Gibson,<sup>2</sup> Cobb,<sup>3</sup> Johnson,<sup>4</sup> Mayo<sup>5</sup> and others, while in Europe Israel<sup>6</sup> is the leading authority among many others. It is to be noted that of these six authors only Brewer and Cobb use the term "acute unilateral septic infarct." The other four speak of hematogenous infection or metastatic abscess.

**Etiology and Syndrome.**—Acute unilateral septic infarct of the kidney is a lesion which is more common in women during the child-bearing period from the twentieth to the fortieth year, than in men, and more frequent on the right than on the left side, for unknown reasons. The essential basis as proved by Brewer<sup>7</sup> is traumatism of the kidney and a source of the infecting embolus. Thus lowered general and local resistance are important elements.

**Symptoms.**—The acute septic process with very rapid invasion, chill, high fever with wide excursions, hard, rapid pulse, depression and prostration is obvious. The focal or renal symptoms and signs are comparatively little inasmuch as many cases show scarcely any material change in the urine, facts which are quite disproportional with the toxemia and systemic disturbance. Acute sensitiveness in the kidney, especially in the costovertebral angle, is present.

The leading subjective complaints are pain referred to any point of the abdominal cavity, fever, symptoms due to septic absorption and prostration. The pain itself is rarely referred to the exact kidney zone and therefore is easily confused with the pain of extrarenal organs such as the gall-bladder, stomach and duodenum in ulcer, appendix and pedunculated cysts, especially ovarian.

Objective examination alone decides on the elements of tenderness of the costovertebral angle, fixation of the abdominal wall over the kidney, pus, epithelia and blood on the affected side if present in cystoscopy, the sudden onset and establishment of the septic state with or without preceding lesions and the practical absence of disturbance of the action of the bladder.

Cystoscopy and ureteral catheterization demonstrate the presence and function of both kidneys; the elements of the disease in urine on the affected side if the foci are discharging pus and blood into the pelvis. Otherwise the urine is negative except for the early signs of congestion and the later signs of nephritis, namely, albumin, casts, epithelia, decrease in quantity of fluid, urea and blood, which, if alone, might be due to traumatism of the ureteral catheter. Negative urinary findings may accompany profound systemic symptoms when the sup-

<sup>1</sup> Surg., Gynec., and Obst., 1906, ii, 485; New York Med. Jour., 1907, lxxxv, 1012; *Ibid.*, 1915, ci, 556.

<sup>2</sup> Med. News, 1905, lxxxvi, 435.

<sup>3</sup> Ann. Surg., 1908, xlviii, 680.

<sup>4</sup> Am. Surg., 1899, xxix, 10.

<sup>5</sup> Collected Papers of the Mayo Clinic, 1915, vii, 336 (published in 1916).

<sup>6</sup> Chirurgische Klinik d. Nieren Krankheiten, 1901, p. 34.

<sup>7</sup> Surg., Gynec. and Obst., May, 1906.



purative focus is subcapsular and does not evacuate itself into the urinary stream. Such negative findings may also persist in the mild cases.

**Treatment.**—The indications laid down by Brewer are as follows:<sup>1</sup> “In regard to treatment, the cases should be divided into three classes:

The severe type, in which the temperature remains high, and the toxemia is rapidly progressive. These cases require nephrectomy at the earliest possible moment.

The milder cases are those in which the initial temperature may be high, but begins to fall within forty-eight hours, and where the toxemia is less marked. These cases may often be successfully treated by decapsulation, which relieves the intense congestion and allows Nature to complete the reparative process. Where one or more cortical abscesses are present they should be opened and drained.

In the mildest type, the case may be treated expectantly with a reasonable prospect of complete recovery, although the writer has observed two or three patients in which a chronic pyelonephritis has remained.”

**Results.**—The outcome is given by Brewer in the same article as follows and very well exemplifies the value of the various forms of treatment:

“Nephrotomy and drainage in five patients of the severe type, all died. Nephrectomy in eight patients of the severe type, all recovered. Nephrotomy, decapsulation and drainage in five patients of the milder type, all recovered. Expectant treatment in four or more patients of the mildest type, all recovered.”

**Suppurative Acute Pyelonephritis.—Definition and Pathogenesis.**—This renal condition is an entity clinically and pathologically and not a complicate of pyelitis but rather a lesion combining both pyelitis and nephritis of suppurative type.

Pathologically it is an extension into the parenchyma from the pelvis and the ureter of suppuration, commonly grafted on trauma and infection of the kidney. Foci of pus and their extension may be secondary to pus elsewhere in the body. The infection may start from the bladder and follow the ureter into the pelvis and the kidney in direct continuity. Urethral, prostatic and other urinary obstructions may be primary and the infection secondary and thus reach the kidney. Vaginal fistulae are important.

**Etiology.**—Suppurative acute pyelonephritis has a causal sequence, which is one of acute suppurative disease due to preceding factors such as trauma and depreciation of the urogenital organs. In young men urethritis and stricture, in old men prostatic hypertrophy and neoplasm, in females repeated pyelitis of pregnancy, pus tubes and periuterine infection. Injury and especially transplantation of the ureter in operation are most common forerunners.

**Syndrome.**—This requires a careful subjective history of facts leading up to antecedent trauma or disease of the kidney, ureter or bladder.

<sup>1</sup> New York Med. Jour., June, 1907.



Two general groups may be generally distinguished, namely, the earlier and milder, and the later and severer cases.

Systemic symptoms of early and mild pyelonephritis are those of absorption due to inactive form of sepsis, irregular fever and rigors, accelerated tense pulse, prostration and tendency to anemia. The symptoms are also of reflex origin, namely, anorexia and gastrointestinal disorder.

Focal symptoms of mild pyelonephritis include pain in the kidney on the diseased side. The compensating hypertrophy of the opposite kidney with its congestion during exacerbations of the disease may give more sensitiveness than the diseased side.



FIG. 295.—Acute pyelonephritis, inner view. Extensive destruction of the kidney in the calyces and the pelvis, likewise thickening and infiltration of the ureter. In the center of the picture are the calyces opened into a distinct cavity of the pelvis, all filled with thick detritus, more than 2 ounces of foul fecaloid pus, but no stones were found in this cavity which opens into the ureter below, which is shown to be extensively thickened. The upper pole of the kidney is seen to be destroyed by the superficial abscess. (Author's case.)

Dysuria may be present and all the symptoms of cystitis may antedate or follow the symptoms of the disease.

If a divided ureter with secondary fistula has been the source of the infection the bladder will be without focal symptoms but urine will be discharged at the distal opening of the fistula in the skin, bowel or vagina, as examples.

Late severe pyelonephritis renders more accentuated all the foregoing symptoms and signs, septic absorption increases and may reach terminal toxemia and true septicemia.

Perinephritic abscess, suppurative acute nephritis and renal abscess,

how the same clinical and cystoscopic picture as intense pyelitis; in fact, suppurative acute nephritis may be only the expression of an active exacerbation of the chronic form, and renal abscess is a focal suppuration, which may give all the signs of a generalization.



FIG. 296.—Old suppurative pyeloureteritis. (Author's case, from surgical and urological services of St. Mark's Hospital.)

Objective symptoms of acute pyelonephritis also vary with the degree of disease present.

Palpation very commonly reveals a prolapsed movable kidney with tenderness but without great sensitiveness when compared with that found in infarct and acute pyelitis. Muscular rigidity is rather common. The opposite unaffected kidney may be more palpable than normal

due to compensating hypertrophy and slightly tender during the congesting which accompanies exacerbations.

*Cystoscopy in suppurative acute pyelonephritis* respects the two classes encountered, namely those without and those with injury of the ureter with fistula.

Cystoscopy in acute pyelonephritis without ureteral fistula reveals both ureters in the bladder in their usual position and discharging urine. The ureteric mouth of the unaffected side is, of course, normal. Meatoscopy of the affected side shows congestion, edema, comparative inactivity, atony, and largely duplicate findings of the meatus of pyelitis. If ureteritis by extension is present, these changes may be extreme and profound.

Urinary discharge from the affected side is rhythmic but atonic. The urine is pus-bearing in rather even mixture and not in clumps, masses or strings, and emits from the ureter in turbid puffs exactly as does blood in red clouds during hematuria.

*Ureteral catheterism* permits free passage without obstruction, easy evacuation if the eye of the catheter does not plug. The more recent and mild the case the less the change in the rhythm and efflux of the urine. Old advanced cases dribble the urine from the catheter without the rhythm.

*Urinalysis of catheterized urines* shows most marked changes during the severe symptoms. The excretion of the diseased kidney is usually acid, albuminous, purulent and filled with every cast except blood-casts, but most especially hyaline, finely and coarsely granular epithelial and pus-casts. The *Bacillus coli communis* is invariably present either in pure or associated culture. Red blood cells are common. Fresh blood usually indicates abrasions by the catheter and hence the wisdom of great gentleness in the examination.

The urine from the normal kidney may be unchanged or that of compensating hypertrophy with congestion, namely a few casts, slight and temporary albumin, renal epithelia and the like. Fresh blood has the same indication, as just stated.

*Functional Renal Tests.*—In suppurative acute pyelonephritis without ureteral fistula are shown from the affected side delay in time and decrease in quantity in all the important tests proportional with the duration and degree of the disease. The unaffected side also shows unfavorable deficiency during exacerbations due to the congestion present in the overworked kidney.

Suppurative acute pyelonephritis with ureteral fistula varies from the foregoing picture according to the site of the fistula, as in the skin, vagina and rectum, as examples, and according to the point of transplantation of the ureter in the bladder.

**Physical Examination.**—Pyelonephritis with fistula reveals the ureteral fistula in the skin by its surrounding dermatitis, in the vagina by its secondary vaginitis, and in the rectum by its consequent proctitis as the commonest points of exit. Other than these facts the physical examination is unchanged from that in other cases of the disease.

Cystoscopy in pyelonephritis with fistula displays the normal ureter discharging urine unchanged in rate, rhythm, quantity or quality. The divided ureter shows commonly no urine or a very little if the fistula does not evacuate the entire output in the unnatural direction. On the affected side there is no ureteric action in older cases but there may be some in the more recent cases, especially when some of the urine escapes into the bladder.

Ureteral catheterism is unchanged on the normal side but on the affected side shows a sensitive or painful obstruction at the site of the wound or division of the ureter which is usually in the vesical third of this tube not far from the bladder, as it is in the pelvic operations on women that accidents to the ureter occur.

**Diagnosis.**—The diagnosis rests on the usual four elements of diagnosis in urology, namely, history, physical examination, laboratory investigation and cystoureteroscopy.

The history should be carefully taken and will be found to contain indefinite and ill-defined facts of septic absorption as previously described.

The physical examination, laboratory investigation and cystoureteroscopy must be relied upon to focus attention on the kidney, which is the chief fact of decision.

**Treatment.**—Suppurative acute pyelonephritis may receive both nonoperative and operative treatment. The lesion is parenchymatous as well as pelvic and therefore beyond the reach of such measures as internal antiseptics and lavage of the pelvis which may alleviate temporarily the symptoms due to the ureteral and pelvic conditions.

Operative measures are the choice and are summed up in nephrectomy, in examples of suppurative diffuse nephritis, and in resection of the abscess cavity in cases of focalized suppurative necrosis.

Suppurative pyelonephritis secondary to divided or injured ureter indicates nephrectomy, because in such cases the infection is ascending from the bladder, vagina, rectum or skin, according to the point of outlet of the ureter. Effort to repair the ureter in the presence of suppurative ureteritis and changes in its immediate annexa in the proximal segment and more or less atony through disuse in the distal segment is useless.

Perinephritic abscess may be an associated or a secondary condition, and of course carries its own indication of free drainage as only a detail of the general operative intervention on the kidney.

The aftertreatment of acute pyelonephritis concerns the building up of the patient's health, the usual surgical care of the field, and very important, the cure of the cystitis which frequently is present.

**Pyonephrosis.**—**Definition.**—Pyonephrosis comprises literally pus in the kidney and the pelvis as the sign of chronic suppurative infection.

Pyonephrosis is analogous to hydronephrosis with infection, pus production and nephritis added.

**Etiology.**—The cause of pyonephrosis involves as underlying factors ureteral obstruction, dilatation, infection and suppuration. The

obstruction may be situated anywhere in the urinary tract distal to the kidney, exactly as in hydronephrosis. Antecedent pathological conditions may, by infection, pass over into pyonephrosis, such as hydronephrosis, chronic pyelitis, pyelonephritis, abscess of the kidney, suppurative nephritis, calculous pyelitis and tumor of the kidney.

The infecting organism is the *Bacillus coli communis* in pure or associated culture.

**Pathology.**—The lesions reveal in varying degree the site and signs of obstruction, dilatation and chronic suppuration of the pelvis of the kidney and then of the parenchyma. The destruction of pressure and



FIG. 297.—Chronic pyelonephritis, inner view. Case of pyelonephritis with practical obliteration of kidney substance and with abscess in the lower pole. Most of the kidney substance was reduced to fat as at A, and fat or fibrous tissue as at B. In the lower pole at C was an abscess cavity containing the *Bacillus coli communis* and the *Bacillus pyocyaneus*. The kidney was densely fixed as shown by the strings of fat and adhesion at D. (Author's case.)

suppuration in the parenchyma leads to all degrees from mild to severe of distortion, deformity and atrophy even to a mere shell of the kidney substance whose typical elements are largely obliterated.

**Syndrome.**—Pyonephrosis shows general urinary and cystoscopic symptoms variously associated mutually or secondary to antecedent conditions such as calculus.

The general subjective symptoms are constitutional and reflex. They are slight or absent in mild cases and marked in severe cases or during absolute obstruction and absorption in relapsing cases. Their character is generally fever, rigors, nausea, with or without vomiting,

stration and debility; in short, all the persistent chronic symptoms show septic absorption.

The blood count is that commonly seen in low pus cases.

The starting-point of the disease is often within the patient's knowledge, as urethra, prostrate, bladder, ureter and kidney. Marked renal signs associated with pregnancy are very common.

Renal symptoms as they develop are indefinite moderate pain in the loin behind or in front, with exacerbations during motion and with obstruction and with relief during the drainage of the pus sac through the normal channel. Early mild cases may have long periods of relief during good drainage of the pelvis, while later older cases always have some symptoms varying in intensity with the obstruction. Palpation shows tenderness, muscular rigidity, enlargement or thickening over the kidney area, which is usually readily verified by manual examination. The colon is commonly found crossing the ureter on percussion.

**Vesical and Urinary Symptoms.**—Chronic cystitis is usually present with increased frequency. As in hydronephrosis ureteral and urethral discharges are usually mild or absent.

The urine of pyonephrosis is a chronic pyuria without tubercle bacilli, but with pus organisms, especially the *Bacillus coli communis*. In the early cases pyuria may cease during acute obstruction and thus be absent in cystoscopy alone, provided, of course, the ureter distal to the obstruction is still healthy.

**Cystoscopy and Its Adjuvants.**—Cystoscopy finds a bladder which inflames easily if there is no cystitis. If cystitis is present it is confined to the immediate annexa of the affected ureter and may not extend, but thus differs from tuberculosis which always extends and not infrequently deposits opposite the affected ureter as well as around it. The bladder of pyonephrosis is not irritable in any high degree, which is another point of difference from vesical tuberculosis.

The affected ureter may be normal or reveal the signs of chronic inflammation, especially after the ureter has become involved in the lower third. Thus the meatus is patulous, deformed and discharges pus as a rule unless the obstruction is complete, when there will be no pus and only pus when the disease has advanced. The function of the ureter is weak, decreased, as a rule, or absent in total obstruction. Relief of the obstruction increases the discharge during the evacuation. The urine is pus-laden in plugs, strings and masses.

**Ureteral Catheterism** is absolutely necessary. The passage of the catheter is usually easy unless the distortion of the canal is great, when the thickening and irregularity of the pass may really prevent complete catheterism. Leakage around the catheter on the diseased side is common on account of these conditions and the dilatation present. Clots of pus may block the catheter, which should be freed by the injection of fluid. The urine as it flows is in steady drops as in hydronephrosis and not in spurts. Residual urine is frequently found in the pelvis.



**Treatment.**—The indications are always operative and involve nephrectomy. The operation, however, should never be done without thorough knowledge of the capacity of the normal kidney to carry on the work of the body.

The aftertreatment of pyonephrosis is much the same as that in pyelonephritis, surgical attention to the field, building up of the patient,

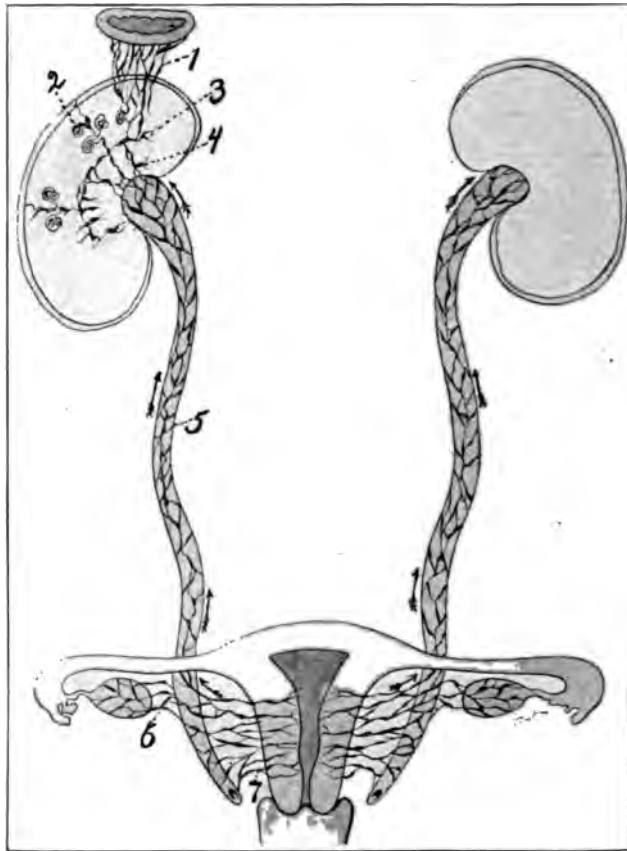


FIG. 298.—Relation of lymphatics of the ureter to those of the internal genitalia of the female and to the colon. 1, lymphatics from colon to cortex of kidney; 2, 3 and 4, periglomerular boundary zone and intertubular lymphatics of kidney (Kumita); 5, communication of periureteral lymphatics; 6, with those of uterus, tubes and ovaries. (Eisendrath and Schultz.<sup>1</sup>)

restoration of the bladder and attention to recovery of the opposite kidney by the usual management for mild renal lesions.

**Conclusions.**—1. While infection of the bladder or lower ureter may reach the renal pelvis or the kidney either by way of the lumen of the urinary tract or by way of the mural lymphatics, experimental and

<sup>1</sup> Jour. Am. Med. Assn., February 17, 1917, p. 542.

clinical evidence indicates that complete or almost complete obstruction to the urinary outflow is necessary for ascent of infection by way of the lumen of the urinary tract.

2. We have shown experimentally that in the absence of complete obstruction the infection may and does pass upward from the bladder by means of the lymphatics of the ureteral wall.

3. Depending on the virulence of the organism and on the susceptibility of the host, the involvement may remain limited to (1) the bladder and ureter, (2) it may pass upward to the pelvis, or (3) it may invade the renal tissues. When the kidney itself becomes involved the inflammatory agent is carried from the renal pelvis to the parenchyma by the lymphatics of the intertubular and perivascular tissues.

4. In the human being the lymphatic network constitutes the most important path of ascending infection when pyelonephritis follows cystitis not associated with complete obstruction to the urinary outflow.

5. In the absence of cystitis the renal pelvis or the kidney itself may become involved by the transport of infection from the pelvic organs or from the lower intestinal tract through the anastomosing lymphatic channels, which anatomic study has shown to be present.

### TUBERCULOSIS OF THE KIDNEY.

**Definition and Occurrence.**—Infection of the organ with the *Bacillus tuberculosis*, either in pure or mixed culture, and showing all primary and secondary the pathological features of similar infections anywhere else in the body, constitutes the definition of this disease. Tuberculosis of the kidney occurs in the early cases on one side, as a rule, but may be bilateral. The pure infections are also in the early cases while the associated infections in the later cases, the *Bacillus coli communis*, are most commonly present.

Tuberculous autopsy findings show renal lesions in the ratio of 1 in 10 cases, while the clinical frequency among surgical renal diseases is according to most operators nearly 1 in 3 cases. The third and fourth decades of life in both sexes are the commonest periods.

**Etiology.**—*Bacillus tuberculosis* alone in the first stages or mixed with pus organisms in the later stages, especially *Bacillus coli communis*, is the exciting organism. The avenue of infection is commonly through the blood current, from the presence of the organism in the system, with or without clinical manifestations, the former comprising the so-called primary cases and the latter the secondary cases. Tuberculous deposits elsewhere in the urogenital tract may actually or seemingly precede the renal manifestations and thus comprise another class of secondary renal cases. It is difficult, however, to see how tuberculosis of the lower sexual and urinary organs such as the bladder and testes may infect the kidneys excepting through the blood current.

**Subjective Syndrome.**—Tuberculosis of the kidney includes systemic, reflex, renal, vesical and urinary symptoms.

The subjective and objective syndromes of tuberculosis of the kidney are as highly variable as in any other form of tuberculosis, hence no description of symptoms will be typical but only suggestive as the following is intended to be.

The systemic symptoms are as follows: The course of the disease shows slow, chronic cases and acute fulminating cases, either of which may be greatly changed at the advent of mixed infection. Like all tuberculosis, the invasion is usually slow, insidious and deceptive, so that many months or several years pass before the patient suffers



FIG. 298

FIG. 298.—Miliary tuberculosis of the kidney. Lobulations, partly anatomical and partly pathological, outer surface tubercles are obvious. The ureter is densely infiltrated and ulcerated at its isthmus and its mucosa filled with miliary tubercles. The absence of adhesions of the kidney to its annexa is remarkable. (Author's case.)



FIG. 300

FIG. 300.—Miliary tuberculosis of the kidney. Anterior surface of uncut specimen. Fewer miliary tubercles than on the posterior surface are seen, but larger nodules of early abscess with tendency toward adhesions are distinguishable. (Author's case.)

enough to seek aid. In this type, when the suppurative stage begins, especially with mixed infection, precisely as in tuberculosis of the lungs, there appear symptoms and signs of septic absorption, chills, afternoon fever, night sweats, emaciation, and the like. If the renal tuberculosis is secondary to a clinical focus elsewhere, the symptoms of the latter are simply colored by those of the former condition.

Acute fulminating renal tuberculosis runs its course in a brief period, especially after suppuration begins. It is in some cases part of a general tuberculous infection.

Subjective reflex symptoms are nausea and vomiting, rarely seen

the period of suppuration is present and advanced. Reflex dis-  
 sence of the bladder is discussed under urinary symptoms.  
 Objective renal symptoms are usually absent in the earlier periods  
 always present in the later stages. At first, in the slow chronic  
 few definite sensations are present, the question of the patient  
 chiefly as to the pus in the urine, and thus the expectant treat-  
 of urinary antiseptics and vesical irrigation is adopted. Later,  
 the disease extends down the ureter, the pain greatly increases



FIG. 301



FIG. 302

301.—Tuberculosis of the kidney. Multiple and discrete abscesses. Inner  
 a. Upper half of kidney totally destroyed by multiple confluent abscesses. Lower  
 specimen invaded by multiple discrete abscesses. Pelvis infiltrated with tuber-  
 Normal kidney markings absent. (Author's case.)

302.—Author's case of tuberculosis of the kidney, after incision, interior view.  
 s the same specimen as shown in Fig. 305. The kidney has been divided from pole  
 e along its free border and into the pelvis, from which a probe is passed through  
 ethra, appearing at the lower edge of the specimen. Openings into numerous  
 s cavities are everywhere apparent, and pus is seen oozing from a small one at  
 per part of the pelvis. Normal kidney substance is absent and many tubercles  
 e seen scattered over the walls of the abscesses, especially those of the upper pole.

ough renal colic is the exception unless obstruction through a  
 plus has occurred.

ne pain is in the renal zone of the affected side, dull and dragging,  
 e during congestion of exposure, physical exercise and menstua-

Cramp-like pains accompany the passage of slugs of mucus or

The normal side in long-standing cases shows the hypertrophy  
 congestion of double duty with no symptoms whatever or more  
 those of the affected side during congestion.

# INFLAMMATIONS OF RENAL PELVIS AND CALYCES



FIG. 303.—Author's case of tuberculosis of the kidney. The upper half of the organ has been deeply invaded and nearly destroyed by abscesses, infiltration and scar tissue. The lower half of the organ is reasonably normal except for early tubercles in the renal pelvis and calyces. One papilla presents in the middle of the figure with an ulcerating tubercle on it. The functional test of this organ was good, although decreased and tubercle bacilli did not appear in the urine during more than a year of persistent pyuria and hematuria. Indefinite sensations rather than pain in the renal zone were manifested.

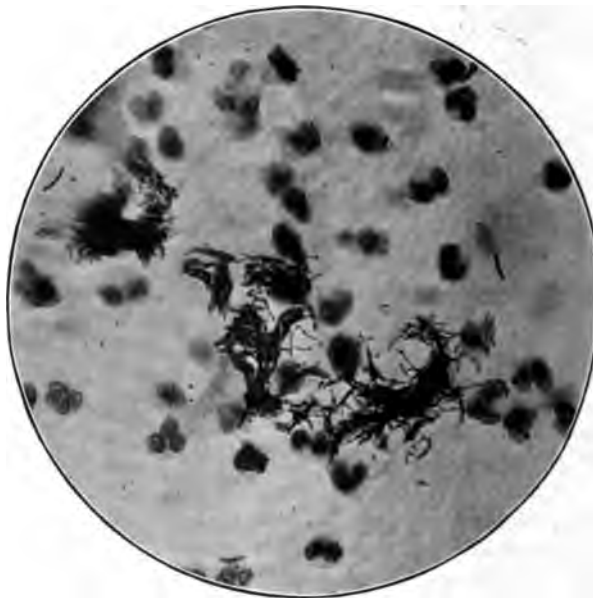


FIG. 304.—Author's case of tuberculosis of kidneys and bladder. The tubercles are shown in many characteristic close masses and bunches.



15.—Author's case of tuberculous pyelonephritis (inner surface). Same specimen as fig. 302. Great enlargement of the organ and numerous prominent lobulations are evident, also adhesions at upper pole. Contracted infiltrated pelvis and very dilated ureter (*U*) are seen in the central picture. (Referred by Dr. Benjamin Franklin.)



16.—Renal tuberculosis in a child. Innumerable tubercles, multiple abscesses and extensive necrosis and alteration in the kidney are evident. *Bacillus tuberculosis* and *Bacillus coli* found. Deficient phenosulphonephthalein test, pain and cystitis, marked the case. Good bodily health without emaciation. Recovery. (Author's case.)



The advent of suppuration passes a mild into a severe case in almost every instance.

Acute fulminating examples of the disease accentuate the foregoing general course of the pain and other renal symptoms.

Tuberculosis associated with other diseases of the kidney becomes an added factor in them, such as lithiasis, displacement, mobility, pyelonephrosis, pyelonephritis, as examples, and may supersede and mask the symptoms of the antecedent condition.

Subjective vesical symptoms are three: pollakiuria, or increased frequency of urination, dysuria, or painful urination, and later, tenesmus. Of these three cardinal symptoms the first is present even in mild cases. As the disease progresses the pain in the bladder appears during the act of urination, and finally tenesmus, at its termination.

The cause of these symptoms is the irritation of the tuberculous process, first in the kidney, and later, by extension, in the ureter and bladder, resulting in positive and rapid advance of suffering. As previously stated, nontuberculous disease in the same parts may cause the same kind but less degree of symptoms.

Objective urinary symptoms are polyuria, pyuria and hematuria. Of these three cardinal symptoms the first is always present even in early forms and regularly accompanies the pollakiuria.

Pyuria, meaning macroscopic quantities of pus, observed and reported by the patient, may be early but is usually later in appearance, but in microscopic quantities pus is an early and important element, as later discussed. It progresses regularly up to very large quantities, is persistent and never disappears as long as the disease is untreated, and its sources are at first renal, then ureteral, and finally vesical. The largest quantities of pus are from the bladder, as a rule, hence the importance of ureteral catheterization.

Hematuria, meaning macroscopic quantities of blood described by the patient, may be early in ulcers of the kidney or pelvis, eroding vessels. This is rather uncommon. Blood in microscopic quantities is always present, and is discussed later.

**Objective Syndrome** comprises physical examination, cystoscopy with its adjuvants and urinalysis, in its objective features. Every patient with this disease is a law unto himself and no type form may be described.

*Physical Examination.*—Physical examination is abdominal and rectal or vaginal.

Bimanual abdominal examination with the bladder empty reveals on the affected side in the early cases nothing definite, in the later progressing cases renal enlargement, thickening, nodulation and tenderness, which still later may be traced along the ureter to the bladder, which is highly irritable. On the normal side there may be more tenderness than on the diseased side through the congestion of overwork, especially in the earlier cases.

Bimanual rectal and vaginal examination with the bladder full in the cases with ureteritis, general or focalized in the lower third of the

canal, develops definite thickening just outside the bladder wall. Earlier cases usually give negative findings. Tuberculous bladders are irritable to touch, whether full or empty. Cystoscopy with its adjuvants in tuberculosis of the kidney includes cystoscopy, meatoscopy, ureteral catheterism, functional renal tests, radiography, bacteriology and animal experimentation. Cystoscopy encounters so highly sensitive a viscus as to require general or spinal anesthesia, as local anesthesia almost always fails because the irritability may not be due to changes in the bladder but to exaggerated reflex influence from the kidney and the ureter above.

The clinical and cystoscopic details of tuberculosis of the bladder are fully discussed in the section on Ureteral Meatoscopy on page 761, and respect the annexa, meatus, ureteric folds and interureteric fold.

In the early cases the annexa of the ureter show three types of change: hyperemia with edema, tubercle formation with infiltration and ulcers with granulations. The hyperemia may be brushed along the floor of the bladder more or less in the direction of the urinary efflux or be irregularly daubed about the meatus like dull red paint. The edema is similarly distributed associated with the hyperemia or predominating over it.

Tubercle formation with infiltrations and vesicles is the next step, at first few discrete and scattered, later many and grouped with vesicles here and there and general infiltration of the mucosa in the same regions.

Ulcers follow breakdown of the tubercles and then granulations appear. These lesions may be few or many, large or small, superficial or deep, and are usually hemorrhagic.

All these lesions may be distributed more or less around the ureteric mouth and trigonum. Occasionally they are found on the bladder wall opposite the affected ureter, where in the empty state of the bladder the mucous membrane rests over the ureter. Early cases show the least number, which in later and terminal stages may involve much or even all the bladder wall.

In some cases ecchymoses are prominent and perhaps predominant more or less interspersed with the other foregoing lesions. They are a little more apt to appear in the more rapid forms.

The diseased ureteric mouth itself in the early cases shows no change whatever or only lesions in association with a given type in its annexa, as just described. As the disease progresses from the kidney as ureteritis and finally reaches the vesical third of the ureter and as the changes in the bladder increase in number, variety and severity, the ureteric mouth takes on distinctive character, embodying thickening, fixity, distortion, deformity, retraction and loss of muscular action. "Golf-hole" ureter is a round, patulous mouth without muscular action. "Tobacco-pouch" ureter is a patulous, retracted, folded mouth. Other forms are angular and irregular in outline. All proceed from the infiltration and thickening and are very common in this disease.

The normal ureteric mouth in early cases may show no changes whatever or a sympathetic edema and congestion along with its annexa; in the later disease when tuberculous ureteritis on the affected side and trigonitis are present with extension of the latter over to the normal side, the changes in the mouth may seem to be considerable but the absence of thickening and prominence in the ureteric fold of this side usually serve to distinguish the comparative simplicity and vesical site of these conditions.

The ureteric fold on the diseased side follows much the same law as does the mouth itself. It is, therefore, unaffected in the early cases but becomes thick, prominent, fixed and inelastic in the later cases. The absence of these conditions in the normal ureteric fold is a diagnostic aid in locating the affected kidney.

Inasmuch as the diagnosis of renal tuberculosis should be made as early as possible while the bladder is relatively not diseased, it is often possible to observe the difference between the two ureteric folds by increasing or decreasing the distention under the field of the cystoscope. This manipulation should always be attempted.

Urinary discharge shows in the early cases no naked-eye variations from the normal unless increased quantity, decreased color and difficult visibility of the swirl. In the later cases purulence may be present and distinguishable in the swirl, especially if there is no cystitis present. Ureteritis and deformity of the meatus commonly show slugs and strings of mucus and pus proceeding from or clinging to the channel. Hemorrhagic cases during the period of bleeding give their own picture of more or less blood from the meatus in the presence of other signs of tuberculosis.

The rate and rhythm of the urinary discharge from the meatus in tuberculosis of the kidney do not vary materially from those seen in other pyogenous renal conditions, such as pyelonephritis, pyonephrosis, and the like. No description other than that already given under these diseases is therefore necessary.

From the foregoing facts it may be concluded that one may draw strong inferences as to the kidney affected without ureteral catheterism or urinary segregation. These investigations should always be carried out but sometimes fail through the pathological conditions of the case or the experience of the cystoscopist.

*Ureteral Catheterism.*—Preliminary cleansing of the bladder should be carried out as thoroughly as possible and as much information obtained at a single investigation as practicable, for the reason that passage of the catheter is not without some danger to the normal ureter and kidney. The final step of the procedure is lavage of the pelvis and ureter with bland solutions and the administration of urinary antiseptics before and after the examination in every case possible, as preventives of infection.

Early cases of the disease may usually have a complete examination at one sitting. The introduction of the catheter is easy on the affected side, especially if gentleness is employed and no traumatism results.

because ureteritis has not yet changed the caliber and elasticity of the canal. The chief point is to select a full-sized catheter for the normal side, 6 F. or 7 F., and a smaller catheter for the diseased side, 5 F. This detail tends to prevent leakage from the normal side and greater ease of passing up the diseased side.

Later cases of the disease will have a ureter still pervious to urine but so thick, tortuous, inelastic and fixed as to render passage of the catheter very difficult or even impossible beyond a few centimeters near the bladder. Here patulousness may cause so much leaking that one has to rely chiefly on the urine from the normal side and that from the bladder for assisting in the diagnosis, hence the wisdom of having a catheter on this side, which so far as possible prevents leakage. It is likewise well to use the method of Casper, of injecting indigo-carmin to establish the presence and degree of the leak.

The chief anatomical sites of difficulty in passing the catheter along the diseased ureter are the deformed meatus and thickened vesical segment, and the point where the ureter crosses the brim of the bony pelvis, after which progress along the canal is apt to be much less difficult.

*Urinalysis* is the laboratory investigation of the case. The diseased side in the early cases shows great increase in quantity, pale color, faint odor, acid reaction and low specific gravity, similar to that in chronic diffuse nephritis, namely, 1010 or thereabout. Progressing cases with more and more loss of kidney function gradually decrease the quantity and have neutral or alkaline reaction. Albumin appears in proportion with the nephritis and the pus, in early cases little, in later cases much, both as serum-albumin and nuclealbumin. Microscopically the tubercle bacillus is always present although repeated examination alone may detect it. Pus and blood in microscopic quantity are constant, especially the former. Gross amounts of pus appear later but like free hemorrhage may be a peculiar, early or unexpected symptom at any time. Desquamation of the renal and pelvoureteral epithelium gives many cells more or less degenerated. Casts in number and character also vary with the nephritis, pyuria and hematuria; in the early cases hyaline and granular casts predominate, while later epithelial and pus casts may appear. In every instance the greater the variety of findings the older, more advanced and destructive the disease.

The normal kidney in the early cases shows little or no variation from the normal quantity of urine, while the diseased kidney is still doing almost full duty. Later on, when the latter is failing, the normal kidney shows an increased output in compensation, of rather pale color, acid reaction and normal specific gravity which tends to fall as the fluid increases but never as low as on the diseased side. Albumin is usually absent excepting temporarily during congestion. Microscopically the normal kidney shows no tubercle bacilli and only during temporary overwork, any casts. At such times there may be present hyaline casts, moderately degenerated epithelium from kidney, pelvis

and ureter, a few leukocytes and red blood cells but no pus beyond a few scattered cells.

*Functional Tests* vary with the actual period and activity of the disease and with the presence or absence of temporary hypertension on the normal organ.

In the early cases there is not a great divergence from the normal. In the later cases, however, the difference increases more or less parallel with the other signs, such as pus, nephritis, blood, and the like. In the average case the normal kidney performs full or excessive function excepting during periods of congestion when the findings will also lapse below the standard.

*Indigo-carmin test* shows on the affected side in early lesions pale blue or yellow-green color in from fifteen to twenty minutes. In the later stages there will be no reaction whatever or a very long delay. It is well to acidify such urines because sometimes the absence of color is a decolorization which is restored by changing the reaction from neutral or alkaline.

The normal kidney in the early cases discharges the usual blue color in from five to ten minutes and in the later stages in from ten to twenty minutes. In other words, during the stage of congestion, it behaves like the diseased kidney in the early stages by delaying the excretion but without, however, the tubercle bacillus and other signs of infection.

*Phloridzin test* develops on the affected side, in the early periods, a delay of about three times the normal, namely, up to thirty or forty minutes, while in the advanced stage there may be no reaction at all or only after sixty minutes. The normal kidney in the early days shows no change from the usual ten or fifteen minutes, which in the later developments advances to ten or twenty minutes. This test, therefore, does not show quite as wide a divergence as does the indigo-carmin.

*Phenolsulphonephthalein test* displays for the affected side in the onset of the disease only slight delay in time and moderate decrease in the total excretion during the first thirty to sixty minutes. In the more destructive period the delay is longer and the loss in quantity much greater during these periods, so that some cases show less than 10 or even 5 per cent. excretion.

The normal kidney in the corresponding periods of the disease gives no change whatever, and even in the later periods less change in time but considerable in the quantity excreted in the first hour, especially when congestion is present.

This test, therefore, is somewhat parallel with the indigo-carmin in its findings as to the time of the appearance of the dye, and being also quantitative is to be preferred to the indigo-carmin when both cannot be used.

*Radiography.*—Radiography in tuberculosis of the kidney includes x-ray photography of the entire genito-urinary tract with and without the injection of fluids impervious to these rays into the bladder, ureter and pelvis of the kidney. The former will frequently reveal changes in the size and form of the kidney, pelvic and ureteral shadows, but the

latter, when practicable, will give the best evidence of all the changes previously spoken of.

**Bacteriology.**—Bacteriology aims to display the tubercle bacillus, which is always present although at times in small numbers and very difficult to find in the early stages but usually easier in the later stages. Several specimens, preferably twenty-four-hour collections of urine, are often necessary before the organism is isolated. In the later periods, when pyuria is prominent, mixed infection is very common, the associating organism being the *Bacillus coli communis*. Animal experimentation involves the injection of the guinea-pig under the most strict antiseptic precautions with the infected urine and then killing and examining the pig in from five to eight weeks for lesions of the disease.

The best usage is regarded as the injection of three pigs, respectively, with the urines from the normal kidney, the diseased kidney and the bladder. If only the last injection is positive the second must be repeated. As a rule, however, only the first-named injection is negative. This test is regarded as the most delicate and reliable when properly done.

**Diagnosis.**—The diagnosis of tuberculosis of the kidney rests on the following cardinal symptoms, which are apt to appear more or less in the following sequence: polyuria; persistent intractable pyuria not corrected by bladder irrigation; diurnal and nocturnal dysuria; irritability, incontinence, and then contracture of the bladder; definite signs of tuberculosis through cystoscopy, catheterization of the ureters and their adjuvants; and last and finally, tubercle bacilli in the urine demonstrated by bacteriology and animal injection.

It is most important to remember that cystoscopic suggestion of tuberculosis of the bladder may show seemingly clear urine from both kidneys, hence ureteral catheterism is absolutely necessary to locate the diseased kidney or to rule out the kidneys as the source of the vesical condition.

**Differential Diagnosis.**—Until the tubercle bacilli appear, the early symptoms of renal tuberculosis resemble several of the other surgical renal conditions. The presence of this organism is therefore the absolute and final distinction. The diseases which may lead to error in diagnosis are the other pyogenic infections of the urogenital tract, such as non-tuberculous cystitis, pyelitis, pyelonephritis, pyonephrosis, nephrolithiasis, renal neoplasm and renal varix.

In all these conditions the early stages are the periods most likely to be confused with the onset of renal tuberculosis, which should properly be recognized before the stages of macroscopic pus or blood in the urine.

*Nontuberculous differs from tuberculous cystitis* in usually giving a history of exciting cause, rapid, severe onset, brief course with prompt benefit from treatment. The cystitis is generalized rather than localized, hence produces much pus at once which washes from the bladder with great difficulty so that a thorough cystoscopy is sometimes defeated by the formation of the pus in the distending medium. The infecting organism is never the tubercle bacillus but either the *Bacillus*



*coli communis*, gonococcus, *Staphylococcus* or *Streptococcus pyogenes*. Much albumin due to the pus is present and the cystoscopic picture is characteristic, as already described. Unless nephritis is an antecedent condition there are never any signs of it and there are no objective signs in the kidney zone of early involvement.

*Pyelitis*, *pyelonephritis* and *pyonephrosis* are somewhat similar in their own onset, course and symptoms. They alike give acute appearance of fever and more or less septic absorption with characteristic fever. The bladder is not so irritable, intolerant and later contracted, and shows no tubercle deposits but rather localized suppurative cystitis. The ureters are not palpable on bimanual examination and the kidney region shows subjective and objective evidence of inflammatory or suppurative process of more rapid type than tuberculosis. The infecting organism is the *Bacillus coli communis*, associated with other pyogenic germs or alone. The most difficult cases are those which later become tuberculous from foci elsewhere in the body or adventitiously, hence the necessity of repeated faithful tests for the *Bacillus tuberculosis*.

*Nephrolithiasis* commonly affords a history of gravel, stone or colic, of vesical symptoms absent during periods of rest and present during attacks of colic or renal irritability. Hematuria is earlier and usually more severe than in tuberculosis and the pyuria, while persistent, is less prominent. Pyonephrosis with a calculus gives a more marked and complex picture. Cystoscopy and ureteral catheterism, especially with the waxed-tip catheters and filiform guides combined with radiography, which should never be omitted, will establish the diagnosis. The other pyogenic organisms and not the *Bacillus tuberculosis* are present, unless the latter has been implanted on the other process, hence this organism must be excluded by repeated careful tests.

*Renal neoplasm* and *renal varix* develop rapid bleeding in the early stages from congestion of the tortuous vessels rather than from ulceration which is the source of the same character of bleeding in tuberculosis. They also show no pollakiuria excepting while the blood is in the bladder. The tubercle bacillus should also be looked for in the way just stated.

**Treatment.**—Nonoperative measures are available only in the early cases without severe symptoms and are the standard forced feeding, hygiene and climate. Such measures have largely been abandoned because it has been shown that even when tuberculous kidneys recover they may at any time light up again in much more intense and dangerous degree of the process.

Operative means are therefore preferred and follow these principles:

With the normal kidney in full function the diseased kidney should be removed.

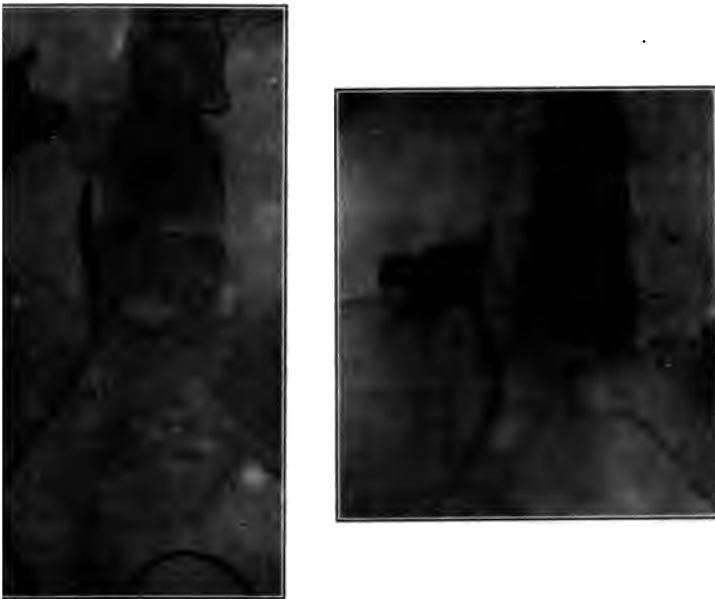
With the normal kidney in nearly full function and with the diseased kidney largely destroyed and the origin of septic absorption, nephrectomy should be done, and usually promises well.

With both kidneys diseased but one much more advanced than the other and with septic symptoms prominent, the more involved organ

be exposed, incised and drained, and later removed if the kidney recovers through relief of the septic poisoning. After treatment comprises the proper medical and surgical treatment of the patient and field and in addition suitable care of the patient which not infrequently promptly and fully recovers after removal of the source of infection.

### HYDRONEPHROSIS.

**Definition.**—Hydronephrosis may be defined as collection of urine in the pelvis of the kidney due to distal obstruction, usually incomplete and recurrent, and less commonly complete and recurrent, and characterized by dilatation and deformity of the renal pelvis and by recurrent



Figs. 307 and 308.—Pyelograms of hydronephrosis with mobility. (Fowler.)

Fig. 307.—Patient recumbent. Right kidney  $1\frac{1}{4}$  inches below normal position. No other indications. Pelvis and ureter normal. Ureteral catheter not into the bladder. Ureter is curled a half turn at end of catheter, which met obstruction 25 cm. from mouth of urethra.

Fig. 308.—Same patient standing. Kidney entirely within pelvis. Rotated on antero-posterior axis so that outer border is facing downward. The kink in the ureter is opposite 12th thoracic vertebra. Diagnosis: right-side intermittent hydronephrosis without pathological changes.

in and evacuation and more or less tendency toward decomposition of urine and infection, but not in the degrees seen in pyelitis. The definition of hydronephrosis is aimed to exclude deformity of the renal pelvis secondary to suppurative inflammation of the kidney

<sup>1</sup> Tr. Am. Urol. Assn., 1912, vi, 186.

or its pelvis, tuberculosis, neoplasm, and with certain exceptions, lithiasis.

**Varieties and Etiology.**—The underlying basis is ureteral obstruction, chronic and incomplete, with more or less persistent symptoms, or recurrent and complete, with more or less intermittent syndrome. In other words, chronic incomplete obstruction never totally prevents some drainage through the ureter, while, on the other hand, recurrent complete obstruction shows periods when the ureter is in virtually normal condition so far as drainage is concerned. Both forms may have acute attacks of symptoms due to the temporary and more positive action of the underlying cause of the obstruction or to such additional factors as congestion or increased infection. The intermittent type of the disease has the more positive degrees of acute attacks.

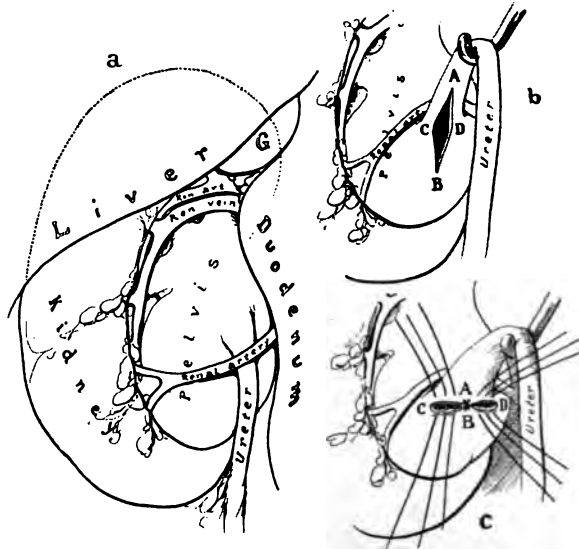


FIG. 309.—Repair of ureteral obstructions in hydronephrosis. The first diagram shows the kidney in position; the second, the incision made in the pelvis and ureter; the third, the closure of this incision and its result on the drainage of the pelvis. (Kelly.<sup>1</sup>)

The causal factors are identical with those of ureteral obstruction and stricture. The intermittent type appears in the third decade of life and is frequent in women through pregnancy. Congenital elements at work are various degrees of maldevelopment, displacement or anomaly of the urinary organ—kidneys, ureters, bladder or urethra in both sexes, and prostate in the male. The outcome of these are torsions, kinks and valves of the ureter. High or lateral implantation of the ureter into the bladder may act similarly. Supernumerary or anomalous bloodvessels of the renal or lumbar group may cross and obstruct the ureter. Pregnancy and other factors in movable kidneys are on the border line between congenital and acquired forms.

<sup>1</sup> Tr. Am. Urol. Assn., 1909, iii, 375.

Acquired causes of hydronephrosis are usually accepted as: Inflammatory or traumatic ureteric stricture, periureteral inflammatory infiltration, peritonitic bands and adhesions, bends and twists of the ureter through inflammation or injury, migratory lithiasis with recurrent impaction, and pressure by tumor in the bladder or ureter or the annexa, most especially the pressure of pregnancy.

The site of obstruction in hydronephrosis is at the isthmus where ureter and pelvis join and where muscle fibers form a kind of sphincter.



FIG. 310.—Hydronephrotic kidney surgically removed. The kidney is lobulated and the pelvis composed of an intrarenal and extrarenal pouch. A vein accompanied by a retracted artery crosses the ureter at its juncture with the pelvis. (Legueu, Papin, Maingot.<sup>1</sup>)

**Subjective Syndrome.**—The chief symptoms are sensory and urinary. The chief complaint is indefinite discomfort interrupted by periods of positive pain. The location of these sensations is in the affected kidney zone, namely, hypochondrium in front and behind in the costovertebral angle or ilio-costal space; maximum during the attack of acute retention; with no definite direction or point of reference through the slow distention; excited by agitation of exercise or travel; relieved by rest

<sup>1</sup> Loc. cit

in bed and evacuation of the backed-up urine; occurring at varying intervals usually longer in the milder cases with tendency to shortening as the disease becomes more deeply seated; constant and persistent as discomfort but as true pain only during acute attacks; intermittent usually absolutely for the true pain during good drainage but only relatively for the indefinite discomfort; accompanied by sense of tumefaction on the affected side and by reflex signs such as anorexia and nausea, sometimes by vomiting and unlike renal calculus rarely by syncope, frequency of micturition, polyuria, oliguria or anuria, but like renal calculus by prostration and exhaustion due to the greater persistence of the attack, the urinary retention and the septic absorption.



FIG. 311.—Section of the same kidney shown in Fig. 310. The parenchyma is reduced to a narrow strip hardly a centimeter wide. All the pouches visible in the undivided specimen together with others are apparent.

The foregoing outline is reasonably typical of intermittent hydronephrosis.

Chronic remittent hydronephrosis shows similar symptoms always present and persistent with periods of exacerbation less marked, however, than the true attacks in the other form.

Fever with or without chilliness rather than true chills is the regular accompaniment of attacks in both forms due to the urinary retention and the moderate septic absorption.

The subjective urinary symptoms are usually slight except in marked cases. The total retention is usually a few ounces, less than a half pint, and slow in its development and likewise, as a rule, in its evacuation

by Nature. These facts are due to the rather slow establishment of total obstruction in both the intermittent and remittent forms. During attacks the opposite kidney is temporarily doing double duty and therefore in a state of congestion with relatively decreased output of urine, in common experience. Large sacs with copious retention and more or less sudden evacuation are extremely rare.



FIG. 312.—Enormous hydronephrotic mass. The specimen consists of two kidneys; the lower is dilated into a very large pouch and the upper, which is small, has a separate ureter and has undergone slight enlargement. (Legueu, Papin and Maingot.)

When the attack is over, the obstruction open, the evacuation established, and the normal kidney relieved of overwork, temporary polyuria may appear through the physical presence of accumulated urine or through reflex sources. As in lithiasis so in hydronephrosis, polyuria may occur through reflex irritation alone.

Frequency of urination through irritation of the bladder is very uncommon; in fact, Pilcher claims that septic infarct of the kidney and attacks of intermittent hydronephrosis are the only acute renal conditions not accompanied by increased frequency of micturition.

**Objective Syndrome.**—Hydronephrosis includes features on urinalysis of mixed and separated urines and cystoscopy with its adjuvants.



*Physical Examination.*—Inspection is negative except in marked cases which give less mobility on the affected side.

Palpation reveals comparative absence of the reflex rigidity of the rectus. During the attack with the sac filled there is commonly a distinct elastic tender mass with the general impression of cyst. Definite fluctuation appears with a mass large enough to permit its classic determination between the two hands. Between the attacks in marked cases thickening of the sac, displacement of the kidney, and similar factors may be palpable.

*Urinalysis of the Mixed and Catheterized Urines.*—The vesical or mixed urine is of little value beyond establishing the signs of moderately purulent urine abundant in renal elements. Separated catheterized specimens, however, should be carefully analyzed. The specimen from the normal or less affected side shows only the albuminuria, decrease of urea and other salts, and microscopic elements of congested kidney. Whereas the urine from the hydronephrotic kidney is turbid with mucus, some pus and phosphates, alkaline and foul from early decomposition and of diverse specific gravity according to the efficiency of the kidney excretion. The pus and all other signs in this specimen vary in direct proportion with the duration and severity of the disease.

*Cystoscopy and Its Adjuvants* are essential and the real crux of the diagnosis and treatment, and include cystoscopy, ureteral meatoscopy, ureteral catheterism, functional tests, measurement and deductions of the capacity of the renal pelvis and radiography.

*Cystoscopy and ureteral meatoscopy* commonly reveal a normal bladder as a whole except for deformity or displacement of the affected ureter. The mouths of both ureters may be normal or that of the affected side implanted high or laterally, or possess a deformed and elongated meatus. The meatus of lithiasis—a common basis of hydronephrosis—is typical and has been described. The changed function of the affected kidney usually disorders the muscular action of the ureter so that the tone is decreased and the urine dribbles rather than periodically spurts. During acute retention there may be no action of the ureter muscularly, certainly no outflow of the excretion. The urine as it is delivered from the affected side may be seen to be colored with mucus and pus while that from the normal side has less or no pus.

*Ureteral Catheterism.*—Meatal malformation and displacement may make penetration of the ureter difficult. In other cases the ease of entrance of the catheter varies with the cause. Once entered, the passage of the catheter is usually not difficult, especially if one of medium caliber in preference to full size is employed.

Congenital deformity of the ureter is usually at the junction with the pelvis about 25 cm. from the meatus and is easy to pass with deliberation in order to allay any spasm, likewise acquired kinks, twists or valves, narrowings of the canal by inflammatory or traumatic strictures, pressure from peritoneal inflammatory deposits, bands and adhesions, or from peri-ureteral inflammation, or from tumors, or from aberrant bloodvessels. Gentleness, deliberation and care should rule.

Lithiasis in the ureteropelvic juncture acting as a ball in a valve is usually found a little higher up, say 30 cm. The catheter reaches the stone, is blocked, begins to displace the stone with pain, hesitates, and then passes the obstruction more or less suddenly, not uncommonly with pain.

Entrance into the renal pelvis is shown much as is entrance into the urinary bladder, through a stricture with a small catheter, by flow of the urine in drops steadily and without periodic muscular action. The quality of the urine varies with the lesion and the quantity with the size of the sac. The eye of the catheter at first reaches the upper and clearer level of the urine so that the first outflow is of reasonably good-looking urine. As the deeper levels are reached, the sediment begins to appear as pus, mucus, phosphates, and the like. Sometimes after a little sediment has come away, the catheter becomes blocked and passage of the pelvis must be instituted in order to evacuate the contents thoroughly.

*Functional Renal Tests* depend on the lesion whose essence is that the affected kidney is in a state of chronic obstruction with exacerbations in the remittent type or of reasonably free drainage with attacks of acute temporary total obstruction in the intermittent type. During such exacerbation or attacks, therefore, the normal kidney is doing extra work and will show on urinalysis albumin, decreased urea and other elements, and according to Albarran, Braasch, Pilcher and other observers, delay in the phloridzin test.

The phenolsulphonephthalein test is likewise altered in the time and quantitative excretion of the dye.

The abnormal kidney necessarily shows profound changes in all the tests, especially during the attack, because there is no flow of urine into the bladder.

In the interval between the attacks, both kidneys in the intermittent form may more nearly approach the normal output while in the remittent form the difference between the two sides may be still great. These divergences are most marked in advanced cases.

**Determination of the Capacity and the Form of the Renal Pelvis.**—The capacity test requires the use of the largest caliber of catheter which will pass the obstruction and the injection of a carefully measured sterilized warm solution of dye within the view of cystoscopic field in order to determine leakage. Indigo-carmin or methylene blue is usually employed, the latter having the advantage of less likelihood of decoloration by the urine.

A graduated syringe of at least 250 c.c. may be employed, inasmuch as anything above 150 c.c. capacity of the sac indicates advanced disease, destruction of the kidney and nephrectomy. The graduations of the syringe must be such as to permit measurements of cubic centimeter differences with reasonable accuracy. Another method is to use a smaller syringe with smaller graduations and a two-way cock, whose suction inlet drains a beaker containing the measured quantity of dye into the syringe and whose outlet delivers into the ureteral catheter.

The affected kidney is catheterized, its sac evacuated and irrigated until clean. Then the dye is very gently flowed into the sac until the patient feels slight pain, such as he describes as suggesting the onset of an attack. During the process the ureter is kept within the cystoscopic field in order to check up the matter of leakage. The size of ureteral catheter cannot ordinarily be the limit of the ureter but rather that of the obstruction.

Determination of deformity and displacement requires the use of the *x*-ray and the distention of the sac with fluid impervious to the *x*-ray. Braasch has done much work in this field. Collargol solution, 10 per cent., colloidal silver oxide, 50 per cent., have been preferred by him, while Keyes and others have used 50 per cent. argyrol solution.

In this work it is well to take an *x*-ray photograph before and during the test for comparison; and likewise to combine both the determination of the capacity and the deformity at the one sitting.

The position of the patient during these tests is important as smaller degrees of displacement and deformity of ureter and pelvis with special reference to the site of the obstruction in movable forms disappear in the lying-down hospital position in some patients, but reappear in the standing position, hence two sets of *x*-ray photographs are required. O. S. Fowler<sup>1</sup> in a long series of cases with *x*-ray studies has shown this fact very well.

*Clinical Significance of the Capacity of the Renal Pelvis.*—Founded on the work of Braasch and others is as follows:

The normal kidney pelvis has a capacity of from 5 to 15 c.c.; a contracted pelvis or one in the midst of edema as in acute and chronic suppurative pyelitis or lithiasis 3 c.c.; a dilated pelvis with destruction of the kidney substance and usually indicating nephrectomy 150 c.c. and above. Between the limits of contracture and dilatation of the pelvis two classes may be placed, namely—a capacity of from 20 to 40 c.c., approximately double the normal, occurs mostly in women through hysteria or other forms of anesthesia with failure to perceive the dilatation as under the pressure of pregnancy; a capacity of from 50 to 150 c.c. indicates hydronephrosis usually of non-operative type but requiring medication, irrigation and other treatment. The larger the capacity of the sac in these cases the nearer the borderline of nephrectomy do they approach.

**Diagnosis.**—The cardinal subjective symptoms of hydronephrosis are renal pain and tenderness or a sense of weight and tumefaction with little change in the act of urination.

The cardinal objective symptoms are during an attack a more or less tense, cystic tumor in the kidney region with a little tenderness, and between the attacks a vague thickening in the intermittent cases, a movable kidney, or in the remittent cases, somewhat more definite change.

The cardinal cystoscopic findings are both ureteral mouths normal or

<sup>1</sup> Tr. Am. Urol. Assn., 1912, vi, 186.

one deformed and displaced and narrowed; efflux of urine absent on the affected side during the attack or flowing feebly and not in rhythmic spurts, or between the attacks the same dribbling of slightly turbid urine from the affected side may continue. Ureteral catheterism relieves the distention of the diseased pelvis in steady dripping, the quantity being according to the size of the sac; as the evacuation is being completed, the cardinal subjective symptoms decrease or disappear. Cardinal urinalysis shows some pus and signs of renal insufficiency to all the functional tests very marked on the affected side, less so on the normal side, during an attack, with decrease of the signs in the intervals.

**Differential Diagnosis.**—This rests on the cardinal points of cystoscopy, ureteral catheterism and radiographic determination of pelvic capacity and deformity. The conditions to be distinguished from hydronephrosis are both renal and extrarenal.

The renal conditions are chiefly lithiasis, tumor, pyonephrosis and pyelitis, and the extrarenal diseases are located in the gall-bladder, appendix, pancreas and ovaries.

*Renal lithiasis* is distinguished from hydronephrosis by history of gravel and colic, severer pain referred to the ureter, scrotum or labium majus, retraction of the scrotum, reflex polyuria, oliguria or anuria, blood, pus, detritus and crystals in the urine. In practically 9 cases in 10 radiography will give a final diagnosis and a good picture. Cystoscopy reveals a characteristic meatus if the stone is below the brim of the bony pelvis within the lower third of the ureter. Ureteral catheterism encounters the characteristic obstruction of stone.

Hydronephrosis may be due to impacted slightly movable calculus and would therefore give the symptoms and signs of both conditions.

*Tumor of the kidney* is distinguished from hydronephrosis by the history of no great pain or other sensation in the kidney region unless a sense of weight later on. Copious and fierce hematuria is regularly a symptom, usually without colic except through clots. Radiography shows enlarged kidneys, deformed pelvis lawlessly contracted or dilated. Pyonephrosis is distinguished from hydronephrosis by the presence of large quantities of pus in the urine with the signs of obvious suppurative inflammation of the kidney. Fever is a more prominent symptom during exacerbations.

*Pyelitis* is distinguished from hydronephrosis by the signs of acute or chronic inflammation with absence of contracture or deformity of the pelvis.

*Cholecystitis and cholelithiasis* are distinguished from hydronephrosis by the following points: The gall-bladder is opposite the ninth rib in front, its pain is central and with migrating stones travels downward and inward, and is referred to the right scapular region. Its attacks are intense with chills and fever. Subjective gastric symptoms precede it for a long time and are present between the attacks. In hydronephrosis the gastric symptoms are more common during the attack, which is accompanied by urinary conditions. The mass in

cholelithiasis is more nearly central and anterior while that in hydronephrosis is lumbar, lower down and posterior. Gall-stones occur in the second half of life, hydronephrosis in the first half. Jaundice is not an uncommon accompaniment of gall-stone, never of hydronephrosis. Between the attacks in cholelithiasis pain may be absent but a degree of discomfort is always present in hydronephrosis. The elements of septic absorption, chill, fever and prostration are greater in gall-



FIG. 313

FIG. 313.—Internal aspect of author's case of hypernephroma, showing extensive lobulation of the growth, total destruction of the normal kidney arrangement, almost complete compression of the pelvis (*P*) and central necrosis of the growth (*N*). The ureter (*Ur*) is much thickened.



FIG. 314

FIG. 314.—This is the same specimen as Fig. 313, but presents the outer surface and shows the prominence of the lobules of the growth. The absence of adhesions is at once apparent. *P* is pelvis and *Ur* ureter, which points upward because the specimen had to be suspended for the photograph by pins in the thinnest part.

bladder disease than in hydronephrosis. Ureteral catheterism and radiography will settle the diagnosis even when the diseased and distended gall-bladder overlies the kidney region.

*Pancreatic cysts* are not commonly confused with hydronephrosis. Careful subjective, objective, cystoscopic and radiographic analysis of the case is required.

*Ovarian cysts* are distinguished from hydronephrosis by the gynecological picture and physical examination.

*Appendicitis is distinguished from hydronephrosis* by the acute onset of pain, focussed at McBurney's point, and marked rigidity of the muscles on that side of the body. Hydronephrosis gives much less severe distress, situated in the hypochondrium and lumbar regions behind. Cystoscopy, ureteral catheterism, urinalysis and radiography will clear up any question of doubt even when a displaced and movable kidney may overlie the appendix.

In all the foregoing extrarenal conditions, the character of the urine should always attract attention to the kidneys.

**Indications of Treatment.**—They are applied operative and nonoperative methods. Surgical interventions are as follow: A sac containing about ten times the normal capacity of 15 c.c. is accompanied by so much atrophy and destruction of the kidney substance with loss of function that removal of the kidney is required. Infection of the sac carrying the disease over into pyonephrosis and accompanied by the same condition of the kidney requires nephrectomy. Pyelorrhaphy or plastic suture of the pelvis and ureter is indicated when the sac is small and the function good for the restoration of any deformity of the pelvis and the relief of stricture. A catheter in the ureter is a serviceable guide in this work. Suture of a movable kidney into its normal bed, ligature and division of a bloodvessel pressing the ureter, and the removal of a stone blocking it, are all indications for appropriate cases.

Nonoperative measures are carried on as follows: During the attack of distention, pain and prostration may be relieved by ureteral catheterism, drainage, lavage with cleansing antiseptic and stimulating solution of mild strength. The drainage of the urine and the detritus in the sac must be thorough and then the medication follows. The retention of the catheter during a brief period may therefore be demanded not over a few hours. The cleansing solution must loosen and dissolve the mucus and pus. The antiseptic and stimulating solution of choice is silver nitrate 1 to 10,000 to 1 to 5000 cautiously increased to 1 to 500 as the case becomes more and more tolerant through the treatment.

Nephrorrhaphy and drainage, consisting in replacing and suturing the kidney in such a position that deformity of the pelvis will drain well and collect residual urine, have been suggested, tried and promise well in many mild cases.

## NEOPLASM OF THE KIDNEY.

**Definition.**—Neoplasm of the kidney is a tumor or a new growth composed of tissue elements having positive histological variations from those of the organ itself.

**Varieties.**—The varieties of neoplasm of the kidney are as follows:

Primary renal tumors are of essentially renal origin and almost invariably unilateral. Secondary new growths of the kidney are metastases commonly of a general carcinosis or of a cancer situated elsewhere.

In origin neoplasms of the kidney are parenchymatous, arising in the



kidney substance itself, or adrenal, starting in the embryonal rest-cells of the suprarenal gland.

Uncomplicated renal tumor consists of the new growth alone, combined with its effects on the kidney, the function thereof, and the system at large. Complicated renal new growths have added to these the local effects of suppurative inflammation in pyelitis, of deformity in hydronephrosis or pyonephrosis, and of foreign bodies in lithiasis.



FIG. 315.—Adenosarcoma of the left kidney. Front view of tumor mass, before operation. (Author's case.)



FIG. 316.—Adenosarcoma of the left kidney. Front view immediately after operation. This is the same patient as shown in Fig. 315. (Author's case.)

Benign neoplasms of the kidney are almost unknown; even papilloma of the pelvis has strong tendencies toward recurrence and malignant degeneration. Malignant new growth of the kidney is the rule, and usually of intense type. Hypernephroma is the usual form, primary in origin, highly malignant, and widely disseminating in its metastases. Sarcoma is primary in origin but occurs almost solely in the first decade of age. Carcinoma is usually secondary and rather rare, or, still more infrequently, primary in advanced age.

**Subjective Syndrome.**—Neoplasm of the kidney has systemic and local signs.

Subjective systemic symptoms may be the earliest and chief complaints or relatively late in appearance. They comprise anemia,

xia, emaciation and weakness, more in type in older and more advanced

Absence of these symptoms does not against the existence of the tumor.

Subjective local symptoms may appear in any and relation, but the commonest are hematuria, discomfort, tumor and urinary disturbance.

Hematuria is due to varicosities as the vessels are pressed and obstructed, or to necrosis as necrosis appears, even of suppurative type. The bleeding is copious, rapid, but clots, as a rule, sudden and unexpected in onset. There may be little or no

even under the microscope between attacks of hemorrhage. Pain during bleeding is rare and seems to be caused by clots. Immediately after a severe hemorrhage, the functional activity of the kidney has been shown to be decreased temporarily than at a previous examination might indicated.

Discomfort and pain are commonly of the dragging ache or sense of weight type in the kidney zone. It seems to be due to distention or the actual mass or to ulceration in various degrees of pain. The typical lancinating pain of cancer often referred to the back, bladder and thigh, is not uncommon. Episodes of pain are constant and slow in their onset without colic unless there are clots passing down the ureter.



FIG. 317.—Adenosarcoma of left kidney. Six months after operation and a very few days before death of thoracic and abdominal secondary deposits. This is the same patient as shown in Figs. 315 and 316. (Author's case.)



FIG. 318.—Adenosarcoma of the left kidney. Front view of tumor, divided along its length as well as possible toward the hilum. Total destruction of kidney substance, together with cavities, thin walls in places, and degenerated tissue and blood clots within the tumor and lying about on the table. This is from the same patient as shown in Figs. 315, 316 and 317. (Author's case.)

Tumefaction of the neoplasm is a subjective symptom rarely noticed until quite late in the disease.

Subjective urinary symptoms are vesical irritability, frequency of urination and pain, and are uncommon in the uncomplicated cases. When, however, the complications of pyelitis, hydronephrosis, pyonephrosis, lithiasis, and the like, have supervened, there appear all the urinary disturbances of these conditions reflected by the bladder exactly as though the neoplasm itself were absent. Hemorrhage by its quantity, rapidity and clots may at any time disturb the bladder.

**Objective Syndrome.**—Neoplasm of the kidney requires physical examination, cystoscopy with its adjuvants, and laboratory findings, for the objective analysis of the case.

Physical examination of the system at large reveals suggestive or obvious state of absorption, anemia, cachexia, emaciation and fever, all according to the development of the case. The blood count will often be that found in neoplasms elsewhere in the body.

Physical examination of the renal region is often negative in early cases, or may merely suggest tumor or resistance. Older cases reveal a distinct enlargement. Metastases may be anywhere and may advisedly be looked for in the lungs and bones of the leg, as examples.

Cystoscopy with its adjuvants should include inspection of the bladder, meatoscopy, ureteral catheterization, functional tests and radiography.

Cystoscopic inspection of the bladder is almost always negative in showing the viscus as a whole normal. Secondary deposits in the bladder are almost unknown.

Ureteral meatoscopy is also negative in early, uncomplicated cases. Later when circulatory and ureteral pressure may have supervened, slight congestion and patulousness of the mouth and prominence of bloodvessels may be suggestive of the affected side but not pathognomonic of lesions. Complicated cases possess a meatoscopy of all the characteristics of the complicating conditions spoken of and described under their respective sections, namely, pyelitis, hydronephrosis, pyonephrosis and calculus.

Ureteral function is likewise little changed in uncomplicated cases. Hemorrhagic forms of the disease reveal blood during the attack and sometimes persistent in microscopic quantities, usually due to ulcerating processes. Between the excretion of urine from the ureter, blood may be seen oozing more or less constantly and without any muscular activity of the canal. Complicated cases of renal neoplasm have the efflux characteristic of the complicating lesions duly described under their respective headings.

Ureteral catheterization in neoplasm of the kidney is usually easy, especially the uncomplicated types, but may be difficult in the complicated forms according to the condition present as part of the complicating disease and for reasons described under these special headings. Large amounts of blood through or around the ureteral catheter followed by decreased functional activity and associated with other

signs is strongly suggestive of neoplasm on that side. Blood alone in very small quantities during the ureteral catheterization may be traumatic and shown by the normal kidney, whose function will vary with such factors as congestion during increased work, displacement of the kidney and traumatism by the catheter.

Functional renal tests are all affected, especially in the advanced cases, namely, polyuria, phloridzin, indigo-carmin and phenolsulphonaphthalein tests. The degree of lost function is that of destruction of the kidney and is therefore in the early, uncomplicated cases comparatively little but steadily progresses with the invasion of the new growth. When the complicating conditions arise they bring with them the functional conditions found in pyelitis, hydronephrosis, pyonephrosis and nephrolithiasis.

*Radiography.*—Radiography in neoplasm of the kidney reveals deformity and displacement of the kidney outline and dilatation, contracture and deformity of the pelvis.

The kidney shadow itself is rarely a large factor but should always be studied.

Pyelometry or measurement of the pelvis of the kidney by filling it with collargol, colloidal silver or argyrol, followed by pyelography or x-ray photography of the pelvis so filled should be carried out in the lying down and standing positions of the patient exactly as in displacement of the kidney. This test will go farther toward studying the relations of the kidney shadow than will the latter alone.

*Urinalysis.*—Urinalysis, especially of the separated specimens, frequently shows hemorrhage in large or small amounts in the uncomplicated cases, combined with some of the elements of nephritis. Complicated lesions show all the analytical findings previously described under these diseases.

The normal kidney is at first not much affected, because at this period even the diseased kidney is doing almost full duty. When, however, the affected kidney has been greatly destroyed and the period of overwork and congestion is at hand, tumefaction, tenderness, functional variation, analytic elements and even subjective symptoms may be present.

Secondary deposits in a kidney originally assumed to be normal may occur and have been described.

*Diagnosis.*—The diagnosis includes the facts of presence of the tumor, of its malignancy or benignancy, of its displacement and deformity of the organ, of its effect on the function of the diseased and the normal kidney, and through the latter fact, decision as to operability.

The earliest possible diagnosis is most important because all kidney neoplasms are highly malignant.

Subjective symptoms are very uncertain in the early period and appear only when general health has been affected, excepting only hematuria which, with the characters described, is cardinal.

Objective symptoms of cardinal value are hematuria, reduced renal function and the suggestion or proof of tumor.

The chief points in the diagnosis are the measure of the function of the opposite kidney and the operability of the diseased organ, which may usually be covered by regarding the relation of all the facts in the case.

**Differential Diagnosis** distinguishes neoplasm from mobility and displacement of the kidney, hydronephrosis, inflammatory conditions, especially suppuration and tuberculosis, idiopathic hematuria and renal calculus.

*Mobility and displacement of the kidney differ from neoplasm* in the earlier and rather more constant symptoms in the usually almost normal function and urine, in the readily palpable displaced organ, and in the definite pyelographic revelations in the standing and reclining positions.

*Hydronephrosis differs from neoplasm of the kidney* in having a mass regularly and earlier within reach, in its common intermittent colic, in its unusual hematuria, and in its persistent and increasing pyuria, in its cystoscopic findings with cystoscope, ureteral catheterization and other adjuvants. Pyelometry and pyelography are again typical and really final in the diagnosis. Hydronephrosis, which is an early sequel of neoplasm, is distinguishable only at the time of operation.

*Suppurative inflammation of the kidney differs from neoplasm* in its typical systemic condition, usually higher degree of nephritis and tendency of the bladder to secondary infection. Cystoscopy with all its adjuvants settles the proof, as shown in previous pages. Complicated cases of neoplasm with the early onset of pyelitis, pyelonephritis and pyonephrosis are established only at the time of operation, hence it is impossible to give any system of clinical distinction.

*Tuberculosis of the kidney differs from neoplasm* in the presence of *Bacillus tuberculosis*, established by bacteriology and animal experimentation, and in the invariable presence of polyuria, pollakiuria, dysuria, typical meatoscopy, tuberculous bladder, and sooner or later tuberculous temperature, absorption and emaciation. Hematuria in tuberculosis is almost always present in slowly progressing microscopic quantities and only very rarely in the copious attacks of neoplasm.

*Idiopathic hematuria differs from neoplasm* in having no cachexia, only anemia which may be severe. The bleeding is of long duration in its history, far beyond the possibility of any neoplasm, namely, often many years. The bleeding is directly related with definite change in the physical economy, such as exercise, rising from bed, overeating, jars and vibration as in falls and railroad or automobile travel. Renal function is decreased only after the bleeding and then temporarily. There are no signs of nephritis or other change in the kidney, and the normal kidney shows no congestion or hypertrophy.

*Nephrolithiasis differs from neoplasm of the kidney* in the constancy of severe colic with vesical disturbance and urinary changes, in the absence of enlargement of the affected kidney, in the findings with wax-tipped catheters, filiform guides and meatoscopy, in its radiography positive for stone in nearly 90 per cent. of all cases, in its detritus in the urine and its pyuria and hematuria, the former pre-

ating largely over the latter. Calculus produced by a neoplasm of early history is recognizable only at the time of operation.

**ment.** — Neoplasm of the kidney has the indications of first, degree of the function of the kidney, because it must perform the duty of two organs; removal of the disease, and the metastases may be within reach; second, operability of the disease itself. If the normal kidney can do the work of the body without surgical intervention is possible by medicinal support of the kidney available. Nephrectomy to remove the disease successfully but thus far from 40 to 50 per cent. of all cases die far within a few years and very few outlive a year.



FIG. 319.—Lithiasis of the kidney, showing a shadow in the pelvis exactly where a ureteral calculus near the outlet would be expected to show. (Author's case.)

#### LITHIASIS OF THE KIDNEY.

**Definition and Varieties.**—Lithiasis of the kidney. Nephrolithiasis

A calculus may be regarded as a calcareous or stone-like concretion found in the kidney or its pelvis. The varieties of nephrolithiasis

are primary and secondary. The primary cases involve the formation of the calculus idiosyncratically, that is, without apparent antecedent renal infection or disease. The secondary cases imply the appearance of the stone through decomposition of the urine after other renal diseases, especially infection, suppuration and obstruction as the underlying conditions.

Renal calculi may also be solitary, or multiple through formation or fragmentation. They may arise in the body of the kidney or in the infundibula. In form they may be spheroid, ovoid or irregularly branched and in size so small as to pass through the ureter to the outer



FIG. 20.—Lithiasis of the kidney. The stone is as of a stone in the left ureter. It can be outside it by the passage of an opaque catheter upward to the stone. The zebra lead catheter is in the ureter. Both ureters are normal in their course. Plate taken October 5, 1914. This is the same case as shown in Figs. 319 to 321 inclusive. (Author's case.)



world with relatively mild symptoms as gravel or sufficiently large to cause intense symptoms in this transit, or so large as to fill the pelvis as a



FIG. 321



FIG. 322

FIG. 321.—Lithiasis of the kidney. This is the same case as in Fig. 319. Shadow is of stone in the left ureter shown to be outside it by the passage of the opaque catheter upward to the kidney. One bismuth catheter is in the right ureter. The plate was taken June 25, 1915, and the mass, probably a lymphatic gland, has enlarged. At the operation the ureter was exposed and palpated but no stone corresponding with the mass found in it. The mass might be condensation of bone substance in the sacrum.

FIG. 322.—Author's case of impacted calculus in the ureter with hydronephrosis. The concretion is well shown with its concentric layers and the opaque catheter passing in front and nearly beside it. Coiled in the rectum is a lead-core, flexible, urethral bougie, size 27 Fr., whose shot filling makes the surface appear sawtoothed.



FIG. 323



FIG. 324

FIG. 323.—Author's case of impacted calculus in the ureter with hydronephrosis. The calculus is distinctly apparent with the opaque catheter passing in front and nearly to one side of it. The shadow of the rectum filled with bismuth paste is shown to be chiefly clear of the stone and a small portion in front of it showing that the stone was not an enterolith. This is the same case as Figs. 319 to 326.

FIG. 324.—Author's case of impacted calculus in the ureter with hydronephrosis. This is the same case as Figs. 319 to 326. The calculus is distinctly apparent with the opaque catheter in front and beside it. The argentine has filled the ureter above it and flowed over its face to the lower pole, thus proving that the concretion was in the ureter.

reaching its remote limits with its branches. The obstruction of the ureter at the mouth or in the course of the ureter may be sudden and



FIG. 325



FIG. 326

325.—Author's case of impacted calculus in the ureter with hydronephrosis. This same case as shown in Figs. 319 to 326, inclusive. Dilatation of the upper ureter, hydronephrosis of the ureter and the dilatation of the pelvis of the kidney are well outlined including the calyces which are individualized.

326.—Lithiasis of the kidney. Secondary and extreme dilatation of the ureteral pelvis, due to the obstruction of the calculus, are shown. This is the same as Fig. 319. (Author's case.)



327.—Author's case of polylithiasis of the kidney. The figure is the inside of the kidney open from end to end, including the ureter, showing great thickening in the wall of the ureter and ureter, destruction of the parenchyma, with multiple stones in the multiple cavities.

absolute or chronic, partial and intermittent in its entire closure. The stones may be "silent," resident in the pelvis with no or few symptoms



FIG. 328.—Radiograph showing large calculus in the right ureter which through its oblique position cast a shadow longer than itself, also showing two small calculi in the bladder just above the symphysis pubis, of the same apparent size as through the cystoscope. The effect of this stone is shown by the kidney of Fig. 329.

for indefinite periods, or "rampant," giving constant symptoms punctuated with intense attacks of renal colic, or fixed, and impacted, resident at a definite point of the pelvis or upper ureter, or movable, changing their position from time to time always with symptoms, or migratory, passing in steady progress or in stages from the pelvis to the bladder, also always with symptoms. The stones may show faceted, rough or smooth surfaces.

**Etiology and Pathogenesis.**—It is probable that all stones in the kidney originate from some previous disease, although symptoms may have escaped attention. Their formation is essentially a precipitation of the urinary salts. In the secondary cases this occurs upon a nucleus of mucus. In the primary cases such nucleus is not



FIG. 329.—Right and left kidneys opened. Front view. In the right kidney, the two major abscess cavities are distinctly seen, the larger involving much of the lower pole axially, laterally, and anteroposteriorly, and the smaller abscess cavity situated above it. The radiographic shadows corresponded more with the abscess walls than with the contained calculi. The pelvis of the kidney as a whole shows signs of chronic inflammation, the mucous membrane being rough and corrugated. The thickening of the pelvic wall is distinctly shown in the cut edge. The ureter appears to be patent. The left kidney is in passable condition and shows the usual changes in chronic diffuse nephritis.

so obvious. When of size too large to pass through the ureter their residence in the pelvis of the kidney traumatizes the mucosa by attri-

infection follows or is augmented along with further decomposition of the urine. Next ensues the development of pyonephrosis, pyelitis and increase of the interstitial nephritis which have preceded the calculus. Obstruction by the stone may occur at any point, as the uretero-juncture, elsewhere in the third of the ureter, at the junction of the bony pelvis or in the third near the bladder. The primary disease or destruction of the kidney is in the early cases tolerable but when deformity of the kidney and pelvis is present—pyonephrosis, decomposition of residual urine, with alkaline infection and precipitation of phosphates adding to the stone already present or forming new calculi.



FIG. 331.—Author's case of extensive lithiasis (operation refused). The kidney is practically replaced by stone of which eight or ten discrete pieces may be distinguished. Pyuria for years, with only occasional scanty menses and with little or no pain characterized the case. Palpation elicited tenderness of the stones and the kidney reached the crest of the ilium. Passed catheter test revealed abundant menses. Excretion of urine and menses abolished. Opposite or left normal to functional test and excretion of urine with variable small amounts of pus.



FIG. 330.—Coral stone of the kidney. The left kidney pelvis is filled with a stone forming a mold of it, with possibly separate stones in addition. The left ureter, right kidney, pelvis and ureter are all negative for stones. (Author's case.)

Even such cases may give relatively bearable symptoms so that such cases are seen in which the pyonephrosis has converted pelvis and kidney into one rather thin-walled sac.

#### Chemical Composition of Calculi.

—Is the same as that found in vesical and ureteral calculi and oxalates, namely, uric acid in most primary cases, phosphates in the majority of secondary cases. Compound stones are found in which a uric acid nucleus, after infection, of the pelvis with decomposition of urine, receives a deposit of phosphates.

*Uric acid calculi* occur in acid urine, often associated with uric acid and urate crystals. They are commonly brown with red or yellow tone.

They are somewhat apt to be small and faceted because multiple, hard rather than soft, ovoid or spheroid, rough and irritating. They commonly form the centers of compound stone with phosphates and other secondary

deposits upon them. They are the most common stone in so-called primary nephrolithiasis.

*Oxalate of lime* stones also occur in acid urine, are brown or blackish, darker than the uric acid calculi, very rough, hardly ever smooth, constituting the so-called mulberry calculus. The urine commonly contains oxalate crystals. Oxalate stones appear in secondary cases, as a rule.

*Cystin* stones are very rare and occur only in acid urine.



FIG. 332.—Author's case of multiple nephrolithiasis. The bottle contains a large stone impacted in and removed from the right ureter. The diagram shows 29 stones removed from the left polycystic kidney. The stones are shown as nearly as possible in the infected cysts or abscesses as found. When compared with the x-ray photograph of this case in Fig. 333, the arrangement of the stones is substantially correct allowing for the fact that the diagram presents the specimens "on the flat" while the photograph is "on three dimensions." (Referred by Dr. Benjamin T. Tilton, who operated with author's assistance.)

*Phosphatic stones* are the rule in alkaline urine, less so in acid urine, are commonly white, spheroid, larger than the others because more rapidly formed, rough but less so than the oxalates. The urine is very full of phosphatic detritus.

**Subjective Syndrome.**—The subjective syndrome includes systemic, reflex, renal, vesical and urinary symptoms.

The subjective systemic symptoms of stone in the kidney are commonly those of indefinite disturbance followed by the symptoms of suppuration and obstruction, such as fever, chilliness, occasional chills, malaise, tendency to loss of weight and strength, and partial or complete anuria from time to time.

The subjective reflex symptoms of renal calculus occur during the attacks of colic and are nausea, vomiting and, at times, syncope.

The subjective renal symptoms of nephrolithiasis are a history of

lic and frequently of passing gravel or sand during a long period followed later by more severe attacks with possibly the passage of concretions. The pain of the colic is in the kidney regions in the lumbovertebral angle behind or along the free border of the ribs in the back. It is the dull ache of pyonephrosis punctuated with cramps of a severe type, sudden in onset, due to disturbance of the stone in its bed. Sensations may be altogether absent except during the colic. Migration or attempts at migration of the stone cause the most distressing cutting, tearing pain with intermissions as the stone momentarily arrested, then with fresh paroxysms as its progress down the ureter resumed. The pain is frequently referred to the bladder, vulva in the female and scrotum and testicle in the male, or down the inner surface of the thighs along the crural branch



13.—Author's case of numerous stones in the left kidney only, as shown in Fig. 13. The ureter is without stones from the sacroiliac synchondrosis, while the right kidney contains a stone well below the pelvic brim and 10 c.c. from the outlet.

genitocrural nerve. Fainting, muscular spasm of the abdomen in the attitude of spastic flexion of the lower extremities or body as may be assumed. Morphine is the only drug in free dose which controls this pain.

The attack varies in length according to the size of the stone, the cause, the distance traveled and the violence of effort to expel a brief period rarely to a prolonged lapse of several hours.

The attack ceases when the stone passes from the ureter into the bladder or comes to rest higher in the ureter after the spasm for its passage has stopped. The stone may never leave the pelvis of the kidney or after migrating a few centimeters return to the pelvis. The



patient is left nervously and physically exhausted and not infrequently severely shocked, with small, thready pulse, pallor, cold perspiration and lowered temperature. Renal and ureteral soreness frequently remains behind on the affected side from the disturbance and on the normal side from the congestion.

After an interval of rest from pain, often of very long duration, days, weeks or months, sudden jar or muscular exercise will provoke a fresh attack. Between the attacks there is no pain in the primary nephrolithiasis without infection and no obvious change in the general health.



FIG. 334.—Renal calculi. One has been rotated on its long axis by the ureteral calculus. (Author's case.)

Primary nephrolithiasis with acute infection is marked by septic symptoms and signs, fever, pus and blood in the urine, pain, tenderness, and tumefaction over the affected kidney with severe local muscular spasm, all added to the picture of the renal colic before, during or after its onset.

Secondary nephrolithiasis shows the symptoms of the antecedent pyonephrosis, pyelonephritis, displaced kidney, and the like, possibly masking the symptoms of the stone until the advent of the attack of the renal colic. Pyelonephritis and pyonephrosis themselves secondary to the renal calculus after infection, give all the symptoms previously described of chronic suppuration of the kidney and its pelvis, which in turn may predominate over the symptoms of the stone.

The opposite healthy or less diseased kidney during an attack of renal colic may be normal and without definite symptoms, or, on account of the pain and hypertension, may become greatly congested and give subjective and objective signs accordingly, during the attack and not infrequently after it, in the latter event occasionally more obviously than the diseased kidney. These findings are most common when the anuria of obstruction is absolute so that the opposite kidney must suddenly take up the entire work of the body.

*Subjective Vesical Symptoms.*—These signs are not very manifest and are chiefly pollakiuria during the attack—a reflex manifestation whose intensity commonly agrees with that of the attack. If the calculus reaches the bladder, in some cases irritability and tenesmus ensue at once.

*Subjective Urinary Symptoms.*—There are four important factors: hematuria, pyuria, sediment and gravel.

Hematuria, or blood in the urine, may occur before, during or after an attack of renal colic. Large quantities of blood are rather rare and when present are usually part of the attack itself. Microscopic quantities of blood are much more common and with few exceptions are a real factor during the attack and continue for some time after the attack, many cases never being without blood as a microscopic element. Blood preceding the attack of colic is least frequently seen. The sources of the bleeding are the wounds of the mucosa made by the stone. Bleeding is more common in the primary and the uninfected cases, as the advent of suppuration with its thick, tenacious discharge seems to reduce the bleeding.

Pyuria, or pus in the urine, shows only in macroscopic quantities in the infected and secondary cases, and is absent as a subjective symptom in the primary uninfected cases. Suppurative nephrolithiasis gives any possible variety in the occurrence and condition of the pus.

Sediment in the urine chiefly as crystals does not often attract the patient's attention unless the quantity is rather large. On urinalysis, however, this condition is reversed.

Gravel, sand or small calculi individual or fragmented are not uncommonly noted by the patient. In the early history of the case, before the true symptoms of the kidney stone are apparent, the gravel and the sand are more common, while in the later history of the case the small or broken calculi occur. Each condition is respectively definitely pathognomonic of the metabolism which leads to the stone formation and of the actual presence of the stone itself.

**Objective Syndrome.**—Nephrolithiasis demands physical examination, cystoscopy with its adjuvants, and urinalysis.

*Physical examination* is in the interval between the attacks of colic, usually negative except for renal tenderness and muscular rigidity in the primary, uninfected cases. The suppurative conditions to which nephrolithiasis is secondary give the signs already described under pyelonephritis and pyonephrosis.

During an attack of renal colic, the patient shows all the objective signs systemically of shock, and locally of renal difficulty of severe type.

*Cystoscopy and its adjutants* include inspection of the bladder, ureteral meatoscopy, ureteral activity, ureteral catheterism, functional tests and radiography.

Cystoscopy reveals a normal bladder in the primary, uninfected cases, whereas the secondary cases give the findings previously spoken of under pyelonephritis and pyonephrosis. They chiefly comprise cystitis localized about the affected ureter.

Ureteral meatoscopy between the attacks of renal colic shows on the affected side in primary, uninfected cases, no definite difference unless a slight suggestion pointing to the diseased kidney. In the secondary, infected cases, however, the findings are those of the antecedent condition, especially the suppurations and tuberculosis. The higher the disease is in the ureter the less the change in or about its mouth as a rule, and *vice versa*.

During an attack of renal colic cystoscopy is practically impossible. The affected mouth is probably contracted in muscular spasm while the normal side is delivering urine in strong, rapid spurts. One would suppose that blood would issue in some cases during the attack while pus might be blocked from its descent.

After an attack of colic, the affected ureteric mouth is sometimes more congested, inflamed and edematous than before, owing to the traumatism above.

Ureteral activity can likewise rarely be studied except in the intervals before or after an attack. During an attack of renal colic Pilcher<sup>1</sup> in one of his own cases states: "The diseased side showed a small dribbling of urine while the normal kidney was delivering urine to the bladder in strong, rapid spurts showing the reflex stimulation." The character of the urine from the affected side will depend on whether or not the case is a primary, uninfected or a secondary, infected case, and whether or not hemorrhage is a factor.

Ureteral catheterism, easy in the primary, uninfected cases, but in the secondary, suppurative cases may present all the difficulties due to the deformity, thickening and inelasticity of the ureters spoken of in preceding pages under suppurative ureteritis. The obstruction by the stone is usually not marked, differing from this condition in ureteric stone. Catheters with waxed tips, filiform guides with waxed tips (Harris' method) and telephonic catheters (Cabot's method) all have their value but in somewhat less degree than in ureterolithiasis. The reasons appear to be that the calculus in the pelvis of the kidney is relatively less closely opposed to the catheter tip and hence scratches the wax less constantly than in ureteric stone. Pelvic calculi are also more movable and pus-covered than ureteric stones and hence less accessible to the wax-tipped instruments.

*Functional Tests.*—The functional tests depend on the destruction of the kidney present and therefore are related with the antecedent, incident and subsequent conditions of the kidney and calculus in their

<sup>1</sup> Practical Cystoscopy, 1911, p. 336.

mutual relations. Primary, uninfected cases usually show the least variation, while the secondary, suppurative cases may show any and all degrees of change from the normal at any given examination and between successive examinations. Necessarily the results of all the common functional tests are affected, namely, the polyuria, phloridzin, indigo-carmin, and phenolsulphonephthalein tests. While the affected kidney thus varies, the healthy kidney will show no change from the normal unless it is itself in a state of congestion.

**Experimental Renal Colic.**—In nephrolithiasis renal pain may be caused by the fact that the diseased kidney is readily excited to colic-like pain by overdistention of its pelvis. This fact points to the side of the disease but does not distinguish inflammatory, suppurative and calculous conditions from each other. The technic is the same as for mensuration of the capacity of the kidney pelves. The writer, however, had a case of very severe reaction in a patient with hydronephrosis notwithstanding strict asepsis and great gentleness. He is therefore of the opinion that such a test in nephrolithiasis should be undertaken with great caution.

**Radiography.**—Positive findings occur in all but 10 per cent. of cases and may be regarded, when positive, as the one incontrovertible proof of renal calculus. It is, therefore, *par excellence* an essential in the examination of all renal cases with pain.

The radiographic work must be carried out and the photographs interpreted by the same experienced expert so that due familiarity with the conditions of the laboratory work will aid in interpretation of the plates and photographs.

Leonard,<sup>1</sup> of Philadelphia, who finally gave up his life to his devotion to x-ray work, formulated the following conditions of a successful renal plate which are now accepted without question in about the following terms:

1. The eleventh and twelfth ribs must be distinctly shown.
2. The transverse processes of the lower dorsal and lumbar vertebrae as wholes must show plainly.
3. The lateral border of the psoas muscle must be clear, and the shadow of the muscle itself unmistakable.
4. The kidney shadow must be sufficiently distinct to reveal the usual outline of the organ.

Cole,<sup>2</sup> however, gives the basis of radiographic diagnosis as follows: "One is not justified in making a negative diagnosis of renal or ureteral calculus, unless a plate of the renal region shows the following detail: (1) The spine and transverse processes should show distinctly all the way to the tip. (2) The outer border of the psoas muscle must show. In some very flabby, fat patients it may not show as distinctly as the kidneys. (3) The eleventh and twelfth ribs should show distinctly, and in many cases the bony detail may be distinctly seen. (4) In about 75 per cent. of the cases the kidney may be seen more or less distinctly,

<sup>1</sup> Quoted by Pilcher, *loc. cit.*

<sup>2</sup> New York Med. Jour., 1908, lxxxvii, 774.

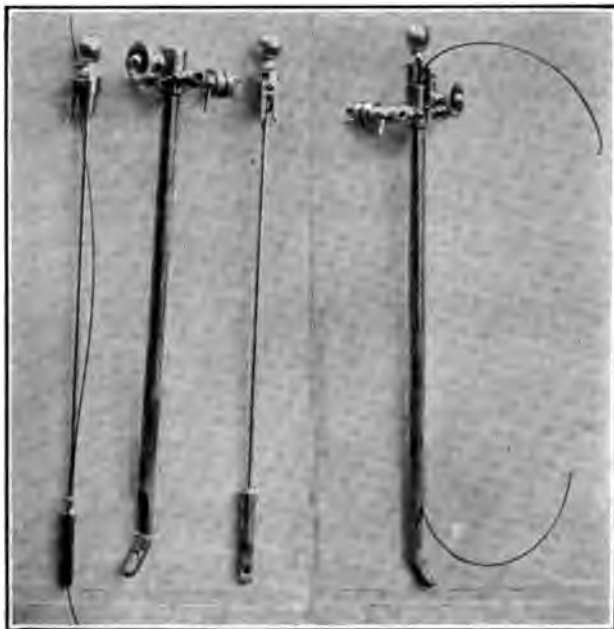
and if special care in technic is used, it may be shown in nearly every case. (5) The liver is frequently seen, and at times it interferes with showing the convex surface of the upper pole of the right kidney. (6) The spleen also may be seen, especially if it is enlarged or congested. (7) Accumulation of gases in the colon and small intestines appears on circumscribed areas, and folds in the walls of the intestines are often seen traversing these areas. (8) Feces in the intestines, especially in the colon, show very distinctly, and interfere very materially with the diagnosis of renal lesions.



FIG. 335.—Unusual pyelogram. Zebra catheter leading to large dense shadow of three-fold grouping of calyces is very apparent. (Author's case.)

*Ureteral.*—The plate of the ureteral region should include the third, fourth and fifth lumbar vertebræ, and part of the sacrum and ilium. The bony detail should show distinctly and the sacroiliac synchondrosis should be well defined. The outer border of the psoas muscle is clear, and the accumulation of gas and feces is frequently seen in the cecum or sigmoid. The course of the ureter is about on a line with the tips of the transverse processes, and at the sacroiliac synchondrosis. Calcified arteries are sometimes seen in the plates.

*Pelvis.*—This plate shows the pubes, bony structure of the spine of the ischium, sacrum and coccyx all the way to the tip. The bladder distended with urine is sometimes well marked, also when injected."



336.—Author's special obturator of the Brown-Buerger cystoscope for wax-catheter test. From left to right is the special obturator with a filiform guide the slot of the obturator and its handle; the naked sheath of the Brown-Buerger cystoscope; the old-style obturator without slots and the cystoscope and obturator led with a filiform guide.



337.—Multiple phleboliths. Nine shadows are shown in close or remote relation to shadow of ureteral catheters. The picture is from a woman having gastrointestinal disorders, with renal symptoms, but no lesions. (Author's case.)





FIG. 338



FIG. 339

FIGS. 338 and 339.—Author's case of ureteral calculus descended by conservative treatment. Fig. 338 shows the shadow catheter in contact with the stone situated about one inch above the spine of the ischium. Fig. 339 details progress of the stone to point nearly three-quarter inches below the spine as indicated by the shadow catheter.

**Diagnosis.**—The diagnosis rests on the following bases: The subjective findings are renal colic recurring through many years usually with increasing severity. Blood and pus in the urine are occasionally important. The objective data in the urine are dense sediment of oxalate of lime, uric acid and in certain conditions phosphates, microscopic and gross quantities of blood and pus, and renal epithelium. Fragments of calculi or small calculi as gravel are important. Ureteral catheterism is relatively not difficult in the absence of ureteral disease. Last, and most important, a series of *x*-ray plates embracing the kidney, ureteral and bladder zones. Negative *x*-ray plates should not be regarded as final unless repeated several times without positive results.

**Differential Diagnosis** involves primarily radiography applied not only to the kidney but also to the ureters. Haenisch<sup>1</sup> gives the following collection of errors in literature:

1. Enterolith of the vermiform appendix (Weisflog<sup>2</sup>).
2. Exostoses of the ilium (Koehler<sup>3</sup>).
3. Sesamoid bone in the tendons of the obturator muscle (Caldwell<sup>4</sup>).
4. Carcinoma (scirrhous) of the head of the pancreas (Caldwell<sup>5</sup>). (Cole.)
5. Gall-stone near the same point (Caldwell<sup>6</sup>). (Cole.)
6. Calcified appendix epiploica (Brewer<sup>7</sup>).
7. Dense fecal scybala (Koenig, Jun.<sup>8</sup>). (Haenisch.<sup>1</sup>)
8. Calcified blood clot in a highly degenerated carcinomatous kidney (Groszlik<sup>9</sup>).
9. Calcification of a segment of the aorta (Fenwick<sup>10</sup>).
10. Masses of bismuth as medication (Baetjer<sup>11</sup>).
11. Masses of salol as medication (Pancoast<sup>12</sup>).
12. Penis displaced upward upon the abdominal wall during the radiography (Kienboeck,<sup>13</sup> Blum<sup>14</sup>).
13. Calcification of tuberculous foci in the kidney (Straeter<sup>15</sup>).
14. Symmetrical calcification of the vasa deferentia (E. Fraenkel<sup>16</sup>). (with numerous phleboliths and calcified arterial branch).
15. Chronic induration of the renal parenchyma (Smart<sup>17</sup>), or scar tissue infiltration (Baetjer<sup>18</sup>).
16. Calcification of the mesenteric and other lymph nodes (Fenwick<sup>19</sup>).

<sup>1</sup> Röntgendiagnostik des Uropoetischen-systems, 1908, pp. 15, 16 and 17.

<sup>2</sup> Fortschr. a. d. Geb. d. Roentgenstrahlen, 1907, x, 217.

<sup>3</sup> Correspondence, Fortschr. a. d. Geb. d. Roentgenstrahlen, 1907, x, 295.

<sup>4</sup> Med. News, 1905, lxxxvi, 761.

<sup>5</sup> Wrongly given by Haenisch as Caldwell, Med. News, 1905, lxxxvi, 441.

<sup>6</sup> Ibid.

<sup>7</sup> Med. News, 1905, lxxxvi, 760.

<sup>8</sup> Loc. cit. and Koenig, Jun., loc. cit.

<sup>9</sup> Monatsber. f. Urol., 1906, viii.

<sup>10</sup> British Med. Jour., 1905, i, 1325.

<sup>11</sup> Am. Quar. Jour. of Roentgenology, 1907, ii, 17.

<sup>12</sup> Remarks in Discussion, Med. News, 1905, lxxxvii, 807.

<sup>13</sup> In a Society Meeting Report, Münch. med. Wehnschr., 1907, liv, 2208.

<sup>14</sup> Loc. cit. <sup>15</sup> Verhandl. d. deutschen Roentgengesellschaft, 1907, iii, 90.

<sup>16</sup> Verhandl. d. deutschen Roentgengesellschaft, 1907, iii, 156.

<sup>17</sup> British Med. Jour., 1905, ii, 617.

<sup>18</sup> Loc. cit.

<sup>19</sup> Loc. cit.

17. Dense cutaneous scar in the kidney region, especially in the back (Haenisch<sup>1</sup>).

18. Defects in the photographic plates themselves. (Blum,<sup>2</sup> and almost all other authors).

The author would add:

19. Calcified spots in the ligaments in the spine and the pelvis (Haenisch<sup>3</sup>).

20. Phleboliths, especially in the veins or the ureter and pelvis. (Pancoast) (Baetjer.<sup>4</sup>)

21. Stones in the prostate (Haenisch<sup>5</sup>).

22. Lime salts in purulent focus of kidney pelvis (Baetjer<sup>4</sup>).

23. Sesamoid bones in great sacrosciatic ligament or muscles (Cole<sup>6</sup>).

24. Mass of gravel (Koenig<sup>8</sup>).

25. Tuberculous gland in pelvis of kidney (Koenig<sup>8</sup>).

26. Stains of thorium in the kidney substance (Busby<sup>10</sup>). Busby's case occurred in the surgical service of one of the large hospitals of New York City. An x-ray plate has proved negative for stone, but after a thorium injection shadows simulating the size, form and position of stones appeared in subsequent plates; these shadows persisted for five days, but at the operation of nephrotomy no stones were found. The nephrotomy was undertaken in the theory that stones previously invisible had been stained and rendered opaque to the rays.

Haenisch in the foregoing article gives his own experience as follows: With Albers-Schoenberg calcification of the end of the twelfth rib (also condensation) apex of transverse process of lumbar vertebrae, calcified myoma, extrauterine pregnancy, prostatic calculi, dermoid cysts, calcification of the media of large arteries (iliac and uterine), deposits on spine of ischium, sacroiliac ligament (not proved), fecal calculi, calculi in ureteral diverticula, phleboliths. Nearly all the foregoing list have plates to prove the diagnosis. Haenisch makes mention of many plate faults. Most writers include blemishes in the plates themselves.

It is to be noted that if shadow catheters had been used during the x-ray examination practically none of these errors would have occurred. This list shows that it is nearly wasted time to make x-ray photographs of the kidneys and ureters without the shadow catheters extending from bladder to kidneys. The ureters in a marked degree and the kidneys in a less notable degree are not constant in number, form, size, position and direction. Many of these anatomical and pathological variations cannot be demonstrated by the x-ray alone even with the shadow catheters. Pyclography is the next step of the demonstration.

The x-ray although it may show a shadow and without the shadow catheter may even strongly suggest that it may be in the ureter, does

<sup>1</sup> Loc. cit.

<sup>2</sup> Loc. cit.

<sup>3</sup> Loc. cit.

<sup>4</sup> In a discussion of a paper, Münch. med. Wehnschr., 1908, lv, 25.

<sup>5</sup> In a personal verbal report before the Medical Progress Club, New York, May, 1917.

<sup>6</sup> Wien. klin. Wehnschr., 1907, xlix, 1539.

<sup>7</sup> Loc. cit., and Pancoast loc. cit.

<sup>8</sup> Loc. cit.

<sup>9</sup> Loc. cit.

<sup>10</sup> Loc. cit.

not show the mobility, the hemorrhagic, the purulent, or the obstructing qualities or the effect of the stone on the function of the kidney. The catheters *in situ* permit the full diagnosis of the case at the one sitting and at the one expense in time and strength for the patient.

Of this long list it is obvious that all those conditions which may be situated anywhere between the twelfth rib and the symphysis pubis in an x-ray plate may simulate stones in either kidney or ureter, while those lesions which are necessarily confined to the general level of the kidney itself resemble lithiasis therein in their shadows rather than in the ureter.



FIG. 340.—Diverticulum of the bladder. Zebra catheter is coiled in the diverticulum, while bismuth catheter passes up the ureter. (Author's case.)

The differential diagnosis is focussed on the subjective symptom, pain, in the renal colic, which must be distinguished from that of cholelithiasis, appendicitis, ovarian disease and locomotor ataxia, and is interpreted by the results of cystoscopy, urinalysis and radiography.

The differential diagnosis in other renal lesions recognizes acute pyelitis, renal tuberculosis, renal neoplasm, renal varix, renal suppuration, lithiasis of the ureters and bladder, and vesical new growth as sources of error.

*Acute pyelitis differs from nephrolithiasis* in sudden, less severe pain, more fixed in the region of one kidney with little tendency toward points of reference. The rapid accumulation of urine in the pelvis causes greater enlargement and tenderness of the kidney and then more acute signs of septic absorption, rigors, fever, leukocytosis with 90 per cent. polymorphonuclears. Pyuria is always present with pollaki-

uria. Radiography is negative on repeated tests. Urinalysis shows no sediment of crystals or fragments of calculi. Ureteral catheterism is unobstructed, withdraws pus-laden urine, and lavage of the pelvis and other treatment completely and quickly relieves the symptoms.

*Renal tuberculosis differs from nephrolithiasis* in the early appearance of polyuria, pollakiuria and dysuria. Bacillus tuberculosis is found by bacteriology and animal experimentation. Cystoscopy shows the early changes in ureter and bladder. Subjective symptoms at first very indefinite and objective symptoms increase in severity without interruption.

Pyuria is an early progressive sign. Calculus forming in a tuberculous kidney adds its findings to the antecedent tuberculosis.

*Renal neoplasm differs from nephrolithiasis* in the bleeding, the tumor, the pain and the pus. Hematuria in tumor is sudden without known exciting cause, copious and recurrent as the one prominent symptom, and usually absent even microscopically between its onsets. No bleeding like this occurs in nephrolithiasis excepting in the unusual condition of a "silent" stone with sudden wounding of its bed. Usually with stone blood is constantly present in microscopic quantities. Enlargement of the kidney in tumor is much more manifest and when distinctly palpable begins to cause subjective discomfort and pain which are devoid of colic, except the rare circumstance of the passage of clots. Pus in the urine which is prominent in lithiasis is absent in neoplasm of the kidney unless necrosis of tissue is present, as in later stages.

*Renal varix differs from nephrolithiasis* much as does neoplasm. Bleeding is the one competent symptom of varix without other signs of kidney involvement, such as tumor, pain, pus, urinary sediment and x-ray findings. Changes in the circulatory pressure as on arising in the morning and on exercise are very apt to excite the bleeding.

*Renal suppuration differs from nephrolithiasis* in the details previously described under the headings of pyelonephritis and pyonephrosis. Stones formed in the kidney secondary to these conditions are often confusing but are usually cleared up by the x-ray plates.

*Lithiasis of the ureters and bladder differs from nephrolithiasis* in the manner detailed under these headings. The x-ray findings in the former are the most important distinction. Stone in the bladder should be recognized ordinarily without the x-ray.

Vesical new growth may simulate nephrolithiasis by the immediate location of the tumor at the meatus of the ureter on the affected side. It is only such cases as give kidney symptoms through obstruction of the ureter but without any of the characteristic severity, periodicity of the pain and urinary conditions of stone in the kidney and pelvis.

**Treatment.**—Nephrolithiasis requires nonoperative and operative measures.

The nonoperative or medicinal methods are purely preventive. A patient in whose urine crystals are abnormal and persistent in quantity may be prevented from forming a true calculus by suitable diet, management and medication and similarly in a less successful degree

patients who have passed gravel or small solitary stones but whose radiographic picture of the kidneys shows no other stone.

The operative measures alone avail if the kidney is the seat of a primary or secondary stone. Even primary, uninfected cases should undergo operation because the presence of the stone sooner or later induces infection, after which the kidney may no longer be serviceable.

Choice of operation lies between the conservative measures pyelolithotomy, nephrolithotomy, pyelorrhaphy and the radical operation nephrectomy.

The conservative steps are undertaken when the proportion of the stone to the pelvis and its relation to the kidney and the pelvis make delivery through the wall of this cavity or the organ possible.

Pyelolithotomy is suitable for primary, uninfected cases in which the kidney is easily deliverable upon the flank and manageable for the division of the pelvis, delivery of the stone and repair of the field. A reasonably long pedicle, absence of adhesions and an otherwise free field are essential.

Nephrolithotomy, namely, division of the kidney substance along the free border over the most prominent part of the stone or throughout its entire length according to indications, should be undertaken when the condition of the field forbids pyelolithotomy.

Pyelorrhaphy, plastic pelvic repair, may be added to either of the preceding operations in the endeavor to correct any pouching or other deformity of the pelvis which may invite recurrence.

Obese subjects, firmly adherent kidneys, perinephritic exudate, short pedicles deeply implanted within the kidney substance are more or less serious obstacles, surmountable by long experience.

Nephrectomy is the radical operation and is applicable to the secondary infected cases, especially those showing destruction of kidney substance and loss of kidney function. Conservatism in such cases is a menace.

Nephorrhaphy, namely, suture of the kidney back into such a position as will secure perfect drainage of a deformed pelvis, has been tried as another conservative operation with some success after a recurrence of the stones.

### RARE FORMS OF DISEASE OF THE KIDNEY.

**Classification.**—Rare forms of disease of the kidney are very difficult to classify because the exact pathogenesis of the more important examples is not understood thoroughly. The chief diseases of interest under this title are asyndromic hemorrhagic, syndromic hemorrhage, cystonephrosis, and renal syphilis.

### HEMORRHAGE FROM THE KIDNEY.

**Synonyms.**—Hemorrhagic disease of the kidney, essential hemorrhage from the kidney, symptomless or painless hemorrhage from the kidney,



also called asyndromic hemorrhage of the kidney and syndromic hemorrhage from the kidney.

**Definition and Varieties.**—Hemorrhage from the kidney must include the asyndromic or symptomless and syndromic or symptomatic varieties of hemorrhage. In both the hemorrhage is so cardinal and important as to be a pathological factor. The idiopathic or symptomless hemorrhage is not a part of a syndrome but stands alone as a symptom without antecedents of definite character, especially of subjective type. The syndromic hemorrhage, on the other hand, is only one of many important symptoms and may therefore be dismissed from further consideration as an unclassified renal condition, except for comparisons.

**Etiology.**—Hemorrhage from the kidney may arise in any of the following conditions: Irritation due to drug and sometimes ptomain poisoning from food. Inflammation as acute congestion, acute and chronic nephritis, tuberculosis and rarely, suppuration. Infectious absorption as in the exanthemata of childhood, chiefly in the type of congestion, degeneration and inflammation. Traumatism by direct, partial or complete rupture of bloodvessels and kidney substance. Lithiasis, by attrition, erosion and ulceration of bloodvessels. Neoplasm by congestion, varicosities and ulceration. Varix by back pressure and weakened walls. Entozoic infection, especially filariasis and distoma hematobium (Bilharz), by influence on vessels and ulceration.

**Diagnosis.**—Hemorrhage from the kidney is recognized by the unusual quantity of blood in the urine, chiefly macroscopic, occasionally microscopic, in both mixed and separated specimens obtained through cystoscopy and ureteral catheterization. The diagnosis must show the origin of blood to be renal. Other sources of bleeding are ureteral and vesical.

*Hemorrhage from the Urethra Differs from Renal Hemorrhage.*—It is usually from the prostate and may readily be recognized by the Wolbarst five-glass test in which the fourth or bladder glass will be almost entirely free of blood if the bleeding is from the prostate, while the third or posterior urethral glass will contain much blood. Prostatic bleeding is also terminal and usually accompanied with other prostatic symptoms, both subjective and objective. Cystoscopy shows no vesical, ureteral or renal signs. Urethroscopy, if possible, reveals a severely congested prostatic neck and posterior urethra. The separated urines are normal, practically identical and blood-free on microscopic investigation.

*Vesical hemorrhage differs from renal hemorrhage* by the presence in the bladder of ulcer, varix, acute inflammation, calculus, neoplasm or other direct bleeding points. Active vesical bleeding is very hard to control by irrigation of the bladder for cystoscopy, blood appearing so quickly as to darken the medium. Preparation of the bladder in such cases indicates administration of ergot or adrenalin internally, mild styptics locally, gentle hot lavage without frequent repetition,

sedatives, rest in bed, and few fluids. If the bladder ceases to bleed temporarily ureteral catheterism reveals normal urines devoid of renal elements. After washing and distentions of the bladder rapid and complete emptying will frequently excite the bleeding anew. The Wolbarst five-glass tests will show the fourth or bladder glass rich in blood.

### ASYNDROMIC OR PAINLESS HEMATURIA FROM THE KIDNEY.

**Definition.**—Painless hematuria from the kidney recognizes the fact that the bleeding occurs apart, by and apparently of itself, being sometimes called essential hemorrhage from the kidney. It is therefore not associated with a syndrome of definite character, especially of subjective type. A diagnosis is made possible only by the most careful search for objective signs to explain the underlying condition which frequently may not be recognized until operation.

Painless hemorrhage from the kidney is the accepted terminology and will be adopted in this work on the ground that pain and discomfort in urological conditions are usually the first noted and complained of by the patient.

**Etiology.**—Painless hemorrhage from the kidney arises chiefly from irritant poisons, acute and chronic nephritis, varix (Pilcher<sup>1</sup>) or angioma (Fenwick<sup>2</sup>), benign papilloma, and as rare exceptions, malign new growths and tuberculosis.

Hemorrhage in the course of cancerous and tuberculous degeneration of the kidney has been fully discussed and needs no separate subdivision under the topic of painless hemorrhage from the kidney.

**Diagnosis.**—Painless hemorrhage from the kidney involves its recognition between and during attacks of bleeding.

*During the hemorrhage* cystoscopy reveals prompt and easy cleansing of the bladder from blood in the preparation unless the flow is extreme. The mouth of the ureter is usually little affected between attacks but during the flow jets of blood from it appear mixed with the urine. The bladder as a whole is always normal.

Tuberculous or cancerous ulcer very near the ureteral mouth may, by its own bleeding, mask essential, symptomless renal blood but the fact of the ulcer is suggestive and ureteral catheterism will aid in the diagnosis. A healthy bladder with blood spurting from one ureter like a volcano with each ureteral contraction or oozing idly between the contraction is strongly suggestive of renal hemorrhage. Ureteral catheterization with separation of the urine shows few or no renal elements, casts, epithelia, crystals or detritus, as in nephrolithiasis, and no *Bacillus tuberculosis*.

*Between the attacks of painless hemorrhage* one kidney as its source is difficult to recognize, except by all possible means of diagnosis. There may be no very definite means of conclusion. Signs of disturb-

<sup>1</sup> Practical Cystoscopy, 1911, p. 357.

<sup>2</sup> Clinical Cystoscopy, 1904, p. 492.

ance may show about the affected ureter in the bladder immediately after the blood has stopped.

**Toxic Painless Hemorrhage from the Kidney.—Varieties.**—Toxic hemorrhage from the kidney includes that due to the ingestion of drugs, mineral and vegetable poisons, and that due to ptomain poisoning from foods, as the chief classes.

**Diagnosis.**—Toxic hemorrhage from the kidney is relatively easy from the history of ingestion of drug or food and the presence of severe nephritis associated with the bleeding. Some of these cases belong to the syndromic form as the nephritis may give its symptoms before the bleeding appears.

**Treatment.**—Toxic painless hemorrhage from the kidney requires administration so far as possible, of chemical and physiological antidotes and elimination of the offending poison and then the usual management and treatment of the damaged kidneys and depressed constitution.

**Painless Hemorrhage from the Kidney in Acute Nephritis.—Varieties.**—Painless hemorrhage in acute nephritis is seen in congestion, degeneration and inflammation of the kidney. All may fully recover with a normal kidney or the inflammation, and sometimes the degeneration, may leave a damaged kidney with progressing disease.

**Etiology.**—Painless hemorrhage in acute nephritis is the same as that of the nephritis itself, namely, irritant poisons of chemical character or of the infectious diseases, especially in childhood and the intense congestion of overwork in generalized burns of the body.

**Subjective and Objective Syndrome.**—Painless hemorrhage in acute nephritis. Independently of the blood itself one finds frequency of urination, vesical irritation, decreased quantity, high color, raised specific gravity, considerable albumin, many casts and epithelia.

After the blood has appeared it may alter the picture by its microscopic or macroscopic quantities and frequency of urination with vesical irritation may be sudden and severe.

Cystoscopy offers little of diagnostic value. If the bleeding is not so severe as to prevent cystoscopy altogether, the examiner will find the hemorrhage bilateral although one side may be more active than the other.

**Painless Hematuria in Chronic Diffuse Nephritis with Exudation.—Subjective and Objective Syndrome.**—This form of nephritis is also known as parenchymatous nephritis and commonly shows frequency of urination through increased quantity of urine, specific gravity of 1010 or lower, pale color, much albumin, all varieties of casts, excepting pus casts, and much renal epithelia. Blood cells are added in attack from microscopic to copious quantities, especially if any cause of congestion supervenes.

Cystoscopy between the attacks is negative except for the nephritis.

During the attack the hemorrhage is shown to be bilateral as a rule although one side may be the more active.

**Painless Hematuria in Chronic Diffuse Nephritis without Exudation.**—**Subjective and Objective Syndrome.**—Renal arteriosclerosis is the other term applied to this form of nephritis. It is marked by increased quantity of urine with frequency, pale color, specific gravity of 1010 and less and no albumin or casts, or a faint trace of albumin and very few casts.

Bleeding in very small or larger quantities may be added in attacks usually associated with congestion of the kidney and a temporary reversion of the nephritis to the exudative type, showing albumin and casts.

Cystoscopy in this form of nephritis is the same as that in the exudative disease.

**Treatment.**—Painless hematuria in nephritis is the same for the acute and both chronic forms. The nonoperative measures are the recognized management and need no description in a work of this kind.

The operative measures are decapsulation to relieve the congestion and pressure on the essential kidney substance. Nephrorrhaphy may be done if the kidney is found to be misplaced.

**Painless Hematuria in Renal Varix (Pilcher) or Angioma (Fenwick).**—Fenwick seems to have been the first to describe this condition, and used the term angioma. Pilcher was the first to use the word varix.

Painless hematuria in renal varix seems to be the best term. There are various other terms applied only to the varix, namely, telangiectasis, varix, nevus, angioma and varicosities.

**Pathogenesis.**—The pathogenesis of painless hematuria in renal varix is not definitely known. Such factors as age, sex and alcoholism seem to have no definite relation with it. The condition is probably analogous to the varicosities found in the saphenous, hemorrhoidal, spermatic, ovarian and gastric veins, or similar to angiomata and nevi of the surface of the body. The varix is unilateral, no bilateral cases appearing in literature. This distinguishes it from the preceding forms of renal hemorrhage in which the lesions and the bleeding are bilateral, such as the poisons of drugs, foods, infectious disease, nephritis, hemophilia, malaria and the like.

**Subjective Syndrome.**—Painless hematuria in renal varix has systemic and local symptoms.

Systemic symptoms are usually absent, the general health is unaffected unless impaired by prolonged, severe bleeding.

Renal symptoms show more subjective sensations in the opposite kidney, as a rule, which must take up more duty during the bleeding. The blood appears suddenly without ascribable cause, such as strain, trauma, nephritis, infectious disease, drugs and colic. Exertion usually augments while rest decreases the hemorrhage. Pain during the hemorrhage is due to distention. Ureteral colic is absent unless clots are being passed, which is not the rule as the clots in this condition are more apt to form in the latter. Vesical distention, irritation and pain are due to rapid filling of the viscus with blood and the clotting.

**Objective Syndrome.**—Painless hematuria in renal varix requires physical examination, cystoscopy with its adjuvants and laboratory analyses for its objective findings.

Physical examination offers but little unless the subjective symptoms are severe when the signs of the normal congested kidney, distended bleeding kidney and the tense bladder may be made out.

Cystoscopy with its adjuvants of hematuria in renal varix reveals normal bladder with blood proceeding from one ureter on inspection. Catheterization of the two ureters gives on the normal side unchanged urine except occasionally for the signs of congestion in severe cases. On the bleeding side much albumin, due to the blood alone, innumerable red cells and frequently hemoglobin. Pus, epithelia, casts, crystals, fragments of stone, gravel, bacteria or *Bacillus tuberculosis* are all absent. Radiography is invariably negative.

**Course.**—Painless hematuria in renal varix shows a recurrent and a remittent type.

Recurrent cases show a large quantity of blood for a few days which disappears even under the microscope. After a period of perfect health the bleeding recurs in the same, less or greater degrees. The respites from symptoms may be weeks, months or years.

Remittent types always show some blood under the microscope which from time to time increases to large quantities with a periodicity similar to that in the recurrent cases.

**Diagnosis.**—The diagnosis of painless hematuria in renal varix considers first, the kidney as the source of blood, excluding the urethra, prostate and bladder, and second, cause of the bleeding as far as possible which, however, usually extends into differential diagnosis.

The subjective history is suggestive in giving no cause, no syndrome, especially pain, and in stating a sudden onset and often many attacks.

The source of the hemorrhage is located with the five-glass test of Wolbarst in excluding the urethra and the prostate and with the urethroscope. Cystoscopy distinguishes between the bladder and the kidney as the bleeding-point. If there is much blood, prescribe preliminary rest in bed, morphin, ergot and local styptics with irrigation, which in bladder bleeding rapidly stops the flow. Ureteral catheterism further distinguishes the kidney from the bladder and from its fellow as the source of hemorrhage.

**Differential Diagnosis.**—Painless hematuria in renal varix is finally determined often only by exploratory operation. It should distinguish the bleeding of hemophilia and malaria among systemic conditions and nephritis, tuberculosis, calculus and neoplasm, especially hypernephroma and papilloma among local diseases.

*Painless renal hematuria in hemophilia differs from varix in a definite history of severe bleeding from any and perhaps all the mucous membranes and after operation or accident. Cystoscopy shows a bilateral lesion.*

*Painless renal hematuria in malaria differs from varix in the history and in the finding of plasmodium malarie in the blood, in its history and commonly in the bilateral character of the bleeding.*

*Painless renal hematuria in nephritis differs from varix* in showing unmistakable findings of nephritis in the urine, particularly during the period of quiescence, as during the bleeding casts are very hard to find. In nephritis with constant remittent hemorrhage and in varix of the same type, distinction is impossible except in operation in some cases.

*Painless renal hematuria in tuberculosis differs from varix* in revealing *Bacillus tuberculosis*. Its bleeding is more apt to be microscopic and is rarely in floods, as in varix. Pus and renal cells, polyuria and pollakiuria are in some degree constant. Cystoscopy reveals ureteritis and cystitis while catheterism is characteristic in its differences between the sides.

*Painless renal hematuria in calculus differs from varix* in its urinary findings of sediment, gravel and stone. Colic is often present and the x-ray settles the matter in 90 per cent. cases. Cystoscopy indicates the affected kidney and the passage of wax-tip filiform guides or ureteral catheters is of service.

*Painless renal hematuria in neoplasm differs from varix* in occurring very suddenly and usually more copiously, and in always recurring at first in small amounts, later in large amounts, and at first at longer, then at shorter intervals, than is common with varix. Renal elements are sometimes present and cachexia rather than anemia is a feature. As in varix there is at first no nephritis which renders the distinction more difficult. Pain at first absent always appears later. In many cases exploratory operation is the final diagnostic point.

**Treatment.**—Nonoperative measures include avoidance of possible exciting causes and the use of hemostatic rest and lavage of the kidney pelvis. These are all of only temporary and indeed doubtful value. The operative measure of choice is nephrotomy. Temporary ligation of the pedicle makes it relatively bloodless so that the kidney may be laid open from end to end and its pelvis thoroughly inspected. This thorough division of the venous lesion into halves seems to reduce the varicosities permanently. Nephrectomy is rarely necessary. Removal of a papilla, the seat of the varix, has been repeatedly and successfully done.

**Painless Hematuria from the Kidney in Benign Papilloma.**—

**Occurrence.**—Painless hematuria from the kidney in benign papilloma is a very rare but important cause of asyndromic renal hemorrhage. It is almost invariably unilateral only.

**Pathology.**—Painless hematuria from the kidney in benign papilloma shows that these villous neoplasms have decidedly malignant tendency, almost always recur and later show cancerous change and degeneration. The growths are solitary and pediculated with various size or sessile and extensive. They may be attached to any point of the pelvis or at the ureteral outlet of the pelvis. At this point they may cause hydronephrosis especially of the hemorrhagic type. The papillomata are usually primary but occasionally secondary, especially to nephrolithiasis. Vesical metastases have been reported but are rare and may mean the same tendency in the bladder.



**Subjective and Objective Syndrome.**—Painless hematuria from the kidney in benign papilloma does not in the strict sense exist until the sudden, unexplained bleeding leads to an examination. The cause of the blood is unknown to the patient except for some minor exciting factor. Its quantity varies, being usually copious and like the onset its disappearance is sudden. Between the hemorrhages there are no subjective symptoms.

Physical examination is negative unless the hemorrhage is in progress when the affected kidney may be large, soft and slightly elastic through the retained blood, and the opposite kidney possibly sensitive from ordinary congestion and overwork. Urinalysis is negative excepting for the blood, as in the primary cases there is neither nephritis nor pyelitis. In cases secondary to stone the findings of this condition may occur. Ureteral catheterism is also negative excepting for the blood from one side in the primary cases. The secondary cases with signs of nephrolithiasis or neoplasm are extremely rare. Functional tests of the kidneys are also negative excepting for occasional decrease directly after cessation of bleeding. Radiography is negative.

**Diagnosis.**—Painless hematuria from the kidney in benign papilloma is absolutely known only at operation unless a fragment of papillary outgrowth is cast off and secured, which would be a very rare occurrence.

**Treatment.**—Painless hematuria from the kidney in benign papilloma may be approached conservatively and operatively. Nonoperative measures aim to control the hemorrhage during its activity by rest in bed, opiates, ergot, adrenalin, and the like, but are of little avail.

Operative measures seek to remove solitary pediculated papillomata without infiltration of the base through a pyelotomy or nephrotomy after temporary closure of the pedicle of the kidney. Nephrectomy is necessary in the recurrent cases and for sessile infiltrating papillomatous growths, which are almost always cancerous.

Papillomata of the bladder, which may be concomitants or metastases of papilloma of the kidney pelvis, should be treated as set forth in the section on Vesical Neoplasms.

### SYNDROMIC HEMATURIA FROM THE KIDNEY.

**Definition.**—Syndromic hematuria from the kidney is a term which simply implies that the bleeding is associated with and subsequent to other subjective and objective symptoms of the disease, of which it is itself only an added symptom.

**Etiology and Varieties.**—Syndromic hematuria from the kidney is caused by renal tuberculosis, nephrolithiasis and renovarix, which have been already discussed under the heading of these diseases in separate sections and under the heading of Painless Hematuria from the Kidney. These three conditions will therefore need no further discussion under this heading.

The chief other types of syndromic hematuria from the kidney are

those caused by trauma, aneurysm of the renal vessels, neoplasm and parasitic disease including particularly *filaria sanguinis hominis* and *distoma hematobium* (Bilharzi).

**Diagnosis.**—In the diagnosis of syndromic renal hemorrhage, bleeding which is only part of a symptom-complex almost always has a characteristic ureteral mouth.

Tuberculosis shows signs of inflammation, as does suppuration, both of definite features. Neoplasm and varix of the kidney rather frequently reveal congestion and edema, with prominent bloodvessels through circulatory interference and a tendency to patency.

Nephrolithiasis has a characteristic urinary discharge, spasm of the ureter with strings and plugs of mucus and renal colic present or declining.

Essential hemorrhage from the kidney may be associated with any of these findings, but such diseases explain the cause of the blood.

Cystoscopy offers very little of diagnostic value as the bleeding is bilateral and the patient often so sick as to make the cystoscopy a profound disturbance and inadvisable.

**Syndromic Hematuria in Traumatism of the Kidney.—Etiology.**—Syndromic hematuria in traumatism of the kidney is caused by rupture of the intrinsic vascular system of the kidney by direct violence of compression, blows and falls, or by indirect violence of muscular exertion, especially of the trunk.

**Diagnosis.**—Syndromic hematuria in traumatism of the kidney regards a sudden, extremely copious hemorrhage. The history reveals the accident or the muscular exertion and the objective signs are those of the traumatism, including the contusion and swelling of the extra-renal blood and distention of the bladder with blood which is drawn off by the catheter. Cystoscopy, if possible at all, will reveal one or both kidneys as its source. The hemorrhage is apt to be for some time too rapid and continuous for cystoscopy. Ureteral catheterism with penetration above the brim of the bony pelvis is usually a dangerous procedure and contraindicated because the ureter is apt to be damaged as much as the kidney, and later because accumulated blood clots mixed with the urine are very prone to infection even without the invasion of the catheter. Urinary segregation might be tried in some cases and found of value.

The diagnosis of the fact of rupture is usually frank and easy but a distinction as to whether one or both kidneys are affected sometimes renders necessary further investigation by the cystoscopist.

**Treatment.**—Syndromic hematuria in traumatism of the kidney has as expectant nonoperative measures the same as all other forms of internal hemorrhage: rest in bed and the administration of copious ergot and other hemostatics. They are adopted if the patient is not in progressing shock from loss of blood and continue until the hemorrhage decreases.

The operative measures in unilateral cases are governed by the last two indications just named, namely, a subsidence of both shock and

hemorrhage. Nephrotomy with packing and pressure are available if the kidney may be saved.

Ureterorrhaphy, or repair of the ureter when damaged with the kidney, is occasionally possible.

Nephrectomy follows continuation of the hemorrhage or infection. After removal of the kidney the bowels and the skin should be made to aid the opposite kidney in performing the body function.

Bilateral extensive trauma of the kidney necessarily contraindicates all intervention.

**Syndromic Hematuria in Aneurysm of the Renal Vessels.—Occurrence.**—Aneurysm of the renal vessels is in the pedicle of the kidney in the main branches of the renal artery. It is a very rare condition. An exact diagnosis is made only on the pathological table after operation.

**Etiology.**—Hematuria in aneurysm of the renal vessels originates from an exciting factor implanted on the usual causes of aneurysm, sclerosis, traumatism, dilatation and perhaps syphilis. Disturbed and congested circulation is probably the source of blood in the urine.

**Subjective and Objective Syndrome.**—Hematuria in aneurysm of the renal vessels is variable, uncertain and indefinite and presents chiefly discomfort, hematuria and tumefaction.

Discomfort or pain is persistent and marked or totally absent. Hematuria is active, copious, alarming and recurrent after periods of rest from bleeding. Tumefaction can hardly be made out easily unless the pelvis of the kidney happens to be crowded with blood.

**Diagnosis.**—The diagnosis of hematuria in aneurysm of the renal vessels rests on the history or traumatism or other cause of aneurysm, the tumefaction if present, and the hematuria. The urine of sclerotic kidney may be present and arteriosclerosis with aneurysmal tendency elsewhere in the body. An exact diagnosis is necessarily impossible until the kidney is out of the body.

Cystoscopy will locate the affected side and reveal the functional capacity of both kidneys and foreshadow the results of operative treatment.

**Treatment.**—The treatment of hematuria in aneurysm of the renal vessels is nephrectomy, if the opposite kidney is up to full work. During the actual bleeding the usual management for internal hemorrhage is applicable. In inoperable cases medicinal means usually employed in aneurysm may be tried.

**Syndromic Hematuria from the Kidney in Filariasis.—Clinical Features.**—Renal infection with *filaria sanguinis hominis* with hematuria occurs in the inhabitants and travelers of the tropics. The chief symptom is a hematuria with or without a chyluria. The bleeding may appear before the lymphatics of the body are obviously involved as in the other genito-urinary organs.

**Diagnosis.**—Decision rests on finding the filaria in the blood, the urine or the lymphatics.

Cystoscopy will serve to reveal the invaded lymphatics of the bladder and the kidney from which the blood is proceeding.

**Treatment.**—As treatment Pilcher<sup>1</sup> applied with benefit intravenous injection of salvarsan to his patient, who presented the following features: chyluria, hematuria, bladder free from lymphatic varices, normal phenolsulphonephthalein reaction and only left renal chyluria, the right kidney secreting normal urine. One injection seemed to cure.

**Syndromic Hematuria from the Kidneys in Bilharz's Disease.**—**Occurrence.**—Hematuria from the kidneys in Bilharz's disease is limited to the inhabitants of the tropics, most commonly of Egypt, or to travelers or temporary residents there who have returned to their native land. Thus in England Fenwick states that after the Egyptian and South African campaigns numerous infections were found among the troops.

**Etiology.**—The etiology of hematuria from the kidneys in Bilharz's disease is the entozoön distoma hematobium (Bilharzia) and the ulcerative processes it produces.

**Subjective Syndrome.**—Hematuria from the kidneys in Bilharz's disease is that of renal and vesical irritability. Pollakiuria is prominent, the hematuria is intractable, the vesical irritability, pain and cystitis are finally severe and the urinary changes frequently lead to vesical and renal lithiasis. In the later stages anemia, emaciation and prostration appear and, with mixed infection, sepsis.

**Objective Syndrome.**—Hematuria from the kidneys in Bilharz's disease has invariably a severe cystitis on cystoscopy, showing cyst-like bodies in which are the ova. Ulceration and rupture follow the cysts and the discharge of the ova. The bladder is in a generally hemorrhagic condition and bleeding from one or both kidneys is obvious. There is a peculiar gray character to the pus. Stones may be present in the bladder or ureters or kidneys.

X-ray examination of the case is negative unless stones are present.

**Diagnosis.**—The diagnosis of hematuria from the kidneys in Bilharz's disease rests on the history of traveling or residence in the tropics and the cystoscopic picture and most important the detection of the ova in the urine and feces. Intestinal hemorrhage in this disease is very common in association with the hematuria.

**Treatment.**—The measures in hematuria from the kidneys in Bilharz's disease are purely expectant. Very little seems to be really curative.

### CYSTS OF THE KIDNEY.

**Synonyms.**—Cysts of the kidney are cystic disease of the kidney, cystic degeneration of the kidney, nephrocysts, cystonephrosis.

**Varieties.**—Cysts of the kidney are primary or idiopathic without known cause or antecedent disease of the organ, and secondary to some form of infection. The secondary cysts are for the purposes of this work not important as they do not change the condition with which they are associated.

<sup>1</sup> Medical Record, March 11, 1911.

The primary cysts are subdivided into monocysts or solitary cysts and polycysts or multiple cysts.

**Primary Monocysts. — Pathogenesis.** — Primary monocysts of the kidney are little understood and are probably idiopathic, without known cause, or embryonal through defect and retention. They are situated at any point or pole but the largest seem to occur at the lower pole.

**Diagnosis.** — Primary monocysts of the kidney are not determined except at the time of the operation unless they are large enough to cause symptoms which are usually those of pressure. Cystoscopy may show a difference between the two sides and uncover a hydronephrosis. Pyelometry and *x*-ray are of service. Accidental aspiration of a cyst with the ureteral catheter is possible but must be a very rare occurrence. Deficiency of kidney function occurs on the affected side.

**Primary Polycysts. — Pathogenesis.** — Primary polycysts of the kidney are not fully understood. Unlike the monocysts they are very rarely unilateral but commonly bilateral in situation. They are of the embryonal retention type, as a rule, but may be acquired frequently in association with cardiovascular disease and anemia. The kidney as a whole is involved and more or less in a condition of chronic nephritis.

Infection is often secondarily added, giving all the pathological findings of pyelonephritis and pyonephrosis.

**Symptoms.** — The subjective syndrome of primary polycysts of the kidney is summed up in discomfort, pain, tumor, frequently displacement of the kidney, various reflex gastro-intestinal disturbances and the results on the kidney in urinary changes, hematuria, insufficiency, nephritis and chronic uremia.

In the objective syndrome of primary polycysts of the kidney, palpation reveals enlargement, sometimes one side more than the other but almost always perceptible on each side. The masses are of irregular surface, soft consistency, the regular normal outlines of the kidneys usually without tenderness but with mobility and displacement.

Cystoscopy is negative as to the bladder but ureteral catheterization reveals a chronic bilateral, rarely unilateral, nephritis.

As the disease progresses infection almost always supervenes, giving the pictures of pyelitis, pyelonephritis and pyonephrosis.

**Diagnosis.** — Primary polycyst of the kidney is frequently found at the time of operation only particularly in the uninfected cases which have the suggestive characteristics of chronic nephritis, anemia, sclerosis of the arteries, cardiac disease and soft tumors in both kidney regions, of which one may be slightly larger than the other.

The infected cases add, of course, pus from one or both ureters on cystoscopy and ureteral catheterization alike.

**Treatment.** — Primary monocysts and polycysts of the kidney must have largely the expectant treatment and management of chronic nephritis if the function of the kidneys is below the limit of safety for operation.

Nephrectomy is the operation indicated in unilateral disease with the other kidney doing full duty but it is contraindicated in bilateral

disease. For this reason it is safe always to expose the opposite kidney if at the operation one is found to be polycystic.

**Echinococcus Renal Cysts.**—**Pathogenesis.**—Echinococcus renal cysts have a rare association with echinococcus infection elsewhere in the body. The cysts are solitary or multiple mother cysts containing the usual multiple daughter cysts.

**Syndromes and Diagnosis.**—Echinococcus renal cysts are not specially definite, resembling mainly primary monocysts in their symptoms, signs and results. Reflex symptoms and slow tumefaction are present. The hooklets in the urine would fix the diagnosis but the mother and daughter cysts may not open into the urinary stream.

**Treatment.**—The treatment of echinococcus renal cysts is nephrectomy unless the disease is bilateral. Removal of the cyst without rupture by nephrotomy might be tried in selected cases.

### SYPHILIS OF THE KIDNEY.

**Pathogenesis.**—Syphilis of the kidney is in the form of nephritis, usually bilateral, occasionally unilateral, during the first, second or third stage of the disease, or in the form of gumma in late, neglected cases.

**Diagnosis.**—The diagnosis of syphilis of the kidney rests on the history of syphilitic infection and usually of somewhat indifferent treatment, on the positive complement fixation tests of Wassermann and Noguchi in the blood, and on the characteristic condition of the spinal fluid.

Cystoscopy and ureteral catheterization will distinguish one kidney as more affected than the other.

A most important diagnostic aid is rapid improvement under treatment.

**Treatment.**—Syphilis of the kidney requires the treatment of any other important visceral involvement, namely, the best possible management and the liberal administration of mercury, iodid of potash and salvarsan.

### HORSESHOE KIDNEY, FUSED KIDNEY, UNILATERAL KIDNEY AND MULTIPLE URETER.

These anomalies are rather common, especially if systematically looked for. Three ureters are by no means unusual with two on one side and one on the other side. The supernumerary ureter is usually lower in the bladder and higher in the kidney, as is the fact in the case of the author shown in Fig. 249. Four ureters are very rare but have been reported. One of the best examples of unilateral kidney which the author knows is detailed in the case of Dr. Smith and pictured in Fig. 343.

History of Dr. F. W. Smith's case (Figs. 341 and 342). Male, twenty-four years of age, complained of more or less constant aching in the



right side, aggravated by movement and relieved by rest; occasionally referred to the bladder neck, scrotum and the right thigh. Various other symptoms for want of etiology would be classified as neurasthenia or psychasthenia. These are chiefly epigastric pain and burning, unconnected with taking food; eructations and a feeling of distention



FIG. 341



FIG. 342



FIG. 343

FIGS. 341, 342 and 343.—Displaced fused right kidney. Fig. 341 is the pyelogram of the double pelvis; Fig. 342 is the ureteral catheters passing up to the kidney of which one has not penetrated all the way; Fig. 343 is the ureteral catheters in the bladder showing the nearly normal arrangement of the openings of the ureters and the sudden divergence toward the right side of the left ureter. There is no left kidney. (Case of Dr. F. W. Smith.<sup>1</sup>)

of the stomach; constipation and flatulence of the colon; vertigo, depression, palpitation and various fleeting neuralgic pains. The patient gave a history of an injury received in Russia, when eighteen years of age and a driver. When turning on a narrow road, he raised the rear wheels and then threw the wagon around and felt severe pain

<sup>1</sup> Personal communication to the author, 1917.

in the right side and heard a cracking sound which he imitated by pulling his finger. He immediately became faint, vomited and was unable to stand or walk. He was placed in the wagon and taken home. Each jolt of the wagon increased his pain. He was confined to his bed and home for two months. Since then he has been ailing, and able to do only the lightest kind of work.

Prior to the accident he was well and strong, and no predisposing factors could be ascertained from past illnesses or congenital or inherited taint. Furthermore there had never been anything to suggest an anomalous or misplaced kidney.



FIG. 344



FIG. 345

FIGS. 344 and 345.—Movable kidney. Fig. 344 shows the patient in the lying-down position with small flexible ureteral bougies in place (Bugbee's method) and the kidneys normally situated. Fig. 345 figure shows the same patient in the erect position with both kidneys displaced, especially the left. The influence of respiratory movement on the bougie is shown on the left side, where two shadows of the bougie are shown. (Author's case.)

Examination showed a poorly nourished, undersized man, with stooping walk and posture, the right shoulder considerably lower than the left, the dorsal spine a scoliotic and convex to the left, and a slight compensatory curve in the cervical region, the abdomen was prominent, and a reniform mass could be determined to the right and below the umbilicus. Varicose veins were in the right leg, probably due to pressure by the tumor. The patient had no urinary symptoms. Cystoscopy showed no pathologic lesions in the bladder. The ureteral orifices were normally placed, and the trigone was symmetrical. The separated urines were about equal in amount, and the findings showed that each kidney was functioning properly and that there was no abnormal content in the urine. The phthalein output also was about equal: 10 per cent. on the right, and 12 per cent. on the left in the first

hour. The appearance time was three minutes on the left, and four minutes on the right side after the intravenous injection.

Opaque bougies were passed up each ureter and the roentgenogram showed that the left ureter crossed the middle line in front of the fifth lumbar vertebra. Thorium pyelograms show a tandem effect. The kidneys are on the same side, one pelvis is directed outward and the other toward the vertebral column. The right ureter is displaced outward. The left is shorter than the right.

The operation showed an unusual end-to-end fusion. The injury doubtless caused dislocation and the lower kidney, by pressure on the iliac vessels at the pelvic brim, probably caused the gastro-intestinal symptoms, pain, varicose veins, etc. The kidney showed the usual lobulations of a congenital misplaced kidney.

The entire mass was raised about two inches and the lower part lifted out of the pelvis and anchored to the dorsal muscles.

Very instructive contributions to the subjects of horseshoe kidney, fused kidney, unilateral kidney and multiple ureter, have been made in this country by Gould,<sup>1</sup> Descherd,<sup>2</sup> Levison,<sup>3</sup> Cecel,<sup>4</sup> Braasch,<sup>5</sup> Stein<sup>6</sup> and others.

<sup>1</sup> Am. Jour. Med. Sc., 1903, cxxv, 428.

<sup>2</sup> Ibid., 1904, cxxvii, 104.

<sup>3</sup> Jour. Am. Med. Assn., 1904, lxii, 1354.

<sup>4</sup> California State Jour. Med., 1915, xiii, 34.

<sup>5</sup> Pyelography, 1915.

<sup>6</sup> Am. Jour. Obst., 1916, lxxiii, 462.

## CHAPTER XVII.

### DISEASES OF THE PROSTATE.

**Varieties.**—Diseases of the prostate are hypertrophy of the prostate, catarrhal and suppurative chronic prostatitis, tuberculous prostatitis, neoplasm of the prostate, and contracture of the neck of the bladder without hypertrophy of the prostate but with symptoms of prostatism. All are of interest to the cystoscopist and will be briefly described from that standpoint.

#### HYPERTROPHY OF THE PROSTATE.

**Subjective and Objective Syndromes.**—Hypertrophy of the prostate is so variable in its manifestations as to be beyond the limits of paragraphs on technical cystoscopy. The influence of the senile changes of the prostate on the bladder and later on the kidneys makes the consideration of the subject in this part of the work more fitting than in the part devoted to vesical condition.

**Cystoscopic Examination.**—In hypertrophy of the prostate cystoscopy is one of the greatest modern diagnostic advances. On account of the changes in form, direction, diameter and length of the prostatic urethra, the short beak lateral vision cystoscopes are best, such as the Otis inspection cystoscope, the Brown-Buerger cystoscope and the Acmi close-field cystoscope. Instruments giving lateral vision and either inverted or corrected images may be used according to the familiarity of the cystoscopist. Pilcher<sup>1</sup> has recently described a close-vision lateral field concave catheterizing cystoscope which is also serviceable.

Acmi subcaliber 13 F. and 18 F. convex, close-vision, lateral field, irrigating, noncatheterizing cystoscopes are of inestimable value in these cases with narrow urethræ.

The Buerger cystourethroscope is, when its passage is possible, available for studying the neck of the bladder and of the prostatic urethra.

**Technic of Cystoscopy.**—The use of the cystoscope in hypertrophy of the prostate includes the preparation of the patient, the bladder and the details of the examination itself.

The preparation of the patient on account of the advanced age usually found requires rest in bed for at least twenty-four hours before and after the examination, internal urinary antiseptics for several days previously and subsequently, full examination of twenty-four hour specimens of urine and when allowable, the use of opium suppository.

<sup>1</sup> Practical Cystoscopy, p. 66.

If the kidneys are in a state of advanced nephritis, pyelitis, or pyonephrosis, this should be revealed by a competent urinalysis, but cystoscopy is contraindicated.

The position of the patient during cystoscopy for hypertrophy of the prostate must be one of comfort so that subsequent change and inconvenience will be avoided.

Moderate universal flexion is the position of choice for most patients. The next choice is the moderate lithotomy position. Some patients are more comfortable with the lower extremities hanging lax at the sides over the end of the table to which the pelvis has been drawn. When the pelvis is raised to meet the eye of the cystoscopist the patient must not experience inconvenience. For this reason the head had best be high on pillows or table-top. Change in the position for elevation of the pelvis must also be accomplished without alteration of the parts to be examined.

The preparation of the urethra and bladder for cystoscopy in hypertrophy of the prostate is the same as in all other forms of irritable, septic cystitis and should respect knowledge of urethral caliber, length and form. Most patients will accept a 16 F. or 18 F. coudé catheter. Other forms which may be tried are the bicoudé, olivary straight and olivary coudé and bicoudé. Catheters are made in these types both circular and oval in cross-section. The cystoscopist should be familiar with them all, and select that which causes the patient least discomfort. Irrigation of the urethra prior to exploration is a wide precaution.

The residual urine is determined in the following manner: The patient makes deliberate effort to evacuate his bladder in both standing and kneeling positions, "on all fours." The catheter is then gently inserted until free flow is secured which is received into a graduate. After this flow has stopped the catheter is advanced, withdrawn, rotated and otherwise manipulated in the bladder until no more urine is obtained. The quantity now in the glass is the residual urine. This reading should be verified by filling the bladder with a measured quantity of warm 2 per cent. boric acid water up to the limit of slight pain, which will reveal the capacity of the bladder. The patient now evacuates this fluid in the same manner as he did the urine, whose force indicates the muscular power or tonicity of the bladder wall. The catheter will now withdraw the residual fluid whose quantity should be practically identical with that of the residual urine, previously obtained.

The length of the urethra is indicated by the following procedure: At the moment when free flow appears through the catheter its eye is fully within the cavity of the bladder. The penis is now released from the hand and soon comes to rest on the catheter at a point which may be marked conveniently with an elastic band. When the catheter is withdrawn the distance between its eye and the elastic band is taken to indicate the length of the urethra, which may be greatly increased over the normal eight inches.

■ The irrigation of the bladder is now begun with warm 2 per cent.

boric acid water through the catheter placed where its evacuating power is best. The flushing is continued until the fluid is clear or nearly clear. It is impossible to remove shreds from the fluid but these do not obscure the view if there is no free pus. The judicious use of alum water will in some cases temporarily check the pus so that a clear field is obtained.

The anesthesia of the urethra and bladder is secured by instilling warm 2 to 5 per cent. solution of alypin in water into the bladder. The catheter is now withdrawn until flow stops, when thin alypin jelly, 5 per cent., is forced through the catheter and distributed along the urethra from point to point as the catheter is withdrawn. All the jelly is carried out of the catheter if the emptied syringe is filled with air and again emptied through the catheter. The penis is now held upright by the patient or nurse for from five to fifteen minutes. At the end of this time anesthesia is completed. Cocain in the urethra in these cases is highly undesirable although some authors teach that cocain absorption will not occur if its solution is put into the urethra first and massaged backward along the canal with the hand, meaning, of course, that catheter instillation of it may traumatize the mucous membrane and excite absorption. Previous administration of morphin is said to be a physiological antidote of cocain intoxication.

Bodine,<sup>1</sup> who was in America one of the pioneers of cocain instillations in major surgery, uses morphin in this manner.

**Insertion of the Cystoscope.**—In prostatic hypertrophy all instrumentation should always be bimanual in order to reduce traumatism. The following method will be found of great service: With the penis held vertical the instrument is passed gently to the bulb of the urethra. The finger is now inserted into the rectum and curved forward to meet the tip of the cystoscope which rests on and turns on the finger and then passes across it to the apex of the prostate where it is again stopped until the finger may be slid along the cystoscope to the same point. The finger now guides the tip of the cystoscope into the prostatic urethra and if needed steadies the prostate itself as far as possible. By this procedure, as a rule, the most accurate possible passage along a tortuous canal is usually rendered rather easy.

**Estimation of Prostatic Thickness.**—After the instrument is in place, the rectal finger may be used to explore the prostate as it lies around the cystoscope. This investigation will give a satisfactory estimate of the thickness of the prostatic hypertrophy projecting backward toward the rectum from the urethra. The thickness of the prostate projecting in front of the urethra toward the symphysis cannot be known before operation.

<sup>1</sup>"My dear Dr. Pedersen. You are quite correct in regard to the morphin before cocain operations. It is invariably our custom in hernia operations to give one-fourth of a grain of morphin hypodermically thirty minutes before beginning the operation. We look upon it as of the greatest importance in preventing cocain symptoms.

With best wishes always, I am

Yours sincerely,

(Signed) JOHN A. BODINE."



On account of the irritability of the bladder in prostatic hypertrophy, it is usually better to leave a small quantity of irrigating fluid in the viscus which may be evacuated and replaced or increased through the sheath of the instrument as needed. In this way the beak of the instrument does not touch the bladder at any point.

Cystoscopes without obturators like the Otis inspection cystoscope had best be inserted with the lens turned out of the fenestrum, in order to avoid smearing them with blood. When the telescope is withdrawn for the distention of the bladder the objective lens had best be inspected in order to be sure that no blood has covered it.

No force during exploration of prostatic hypertrophy in the insertion of the cystoscope or other instrument should ever be used (1) because of traumatism and the danger of septic absorption through opened lymphvessels and bloodvessels, and (2) because of the secondary edema of the prostate with obstruction of the urethra of rather obstinate degree. Gentleness, deliberation and precision should be used as the contraries of force, haste and uncertainty in technic.

**Clinical Details of Cystoscopy.**—Hypertrophy of the prostate concerns the main subjects of the bladder as a whole and of the prostatic protrusions.

The bladder as a whole is studied as to its four segments—ureterotrigonal, subperitoneal, urachal and retropubic and in each of these subdivisions as to inflammation, trabeculations, sacculations, diverticula, deformities, especially of the retroprostatic pouch, and stones.

The ureterotrigonal segment of the bladder is the first explored because it overlies the prostate, may be much affected by changes in the gland and imperfectly studied in the short time allowed by the irritable bladder. As in the method described by the author under the subject of technic in cystoscopy, after the air bubble at the highest point of the bladder has been recognized, the instrument is rotated through 180 degrees to the middle line of the fundus, in which it is advanced or withdrawn until the interureteric fold is located. This is then studied along with the ureteric fold. The ureters are observed for size, deformity, normal and abnormal discharge of urine, and the presence of mucus, pus or blood.

Meatoscopy is difficult because of the prominence of the prostatic body. Over this the objective lens must reach and be made to approach the object as nearly as possible within good focus. It is therefore best to carry the eye-piece toward the opposite side of the body until the shaft of the instrument is nearly parallel with the thigh and then by raising the eye-piece and withdrawing or advancing the instrument bring the ureter of the opposite side into view. After this, its fellow is studied in the same way.

Changes in the meatus do not occur, as a rule, through prostatic enlargement unless ureteritis, pyelitis or pyonephrosis has occurred. Obstruction of the ureter is still more rare unless cancer of the prostate is present. In questions of doubt the ureteral catheter settles the matter.

The trigonum as a whole is then studied by field-zones 180 degrees

in extent by the plan of withdrawing the instrument detailed in preceding pages.

In the same manner the remaining three segments—subperitoneal, urachal and retropubic—are explored as carefully as the general and vesical condition will permit.

Inflammation of the bladder may be acute but more usually is chronic or an exacerbation of chronic disease. The acute inflammation shows various degrees of localized or generalized congestion and hyperemia proportional with the severity of the subjective symptoms. The chronic inflammation reveals pallor, absence of vessels, edema, infiltration, inelasticity, mucus, pus and perhaps blood, in stringy, flaky or fluid form, scaling of the epithelium or of phosphatic deposits and stone—all in various association and relation.

The sequels of inflammation are practically accentuation and extension of these conditions.

*Trabeculations of the Bladder.*—Hypertrophy of the prostate may have congenital or acquired trabeculations. The congenital forms are seen in the early cases before obstruction and cystitis begin, are purely anatomical peculiarities, may disappear under increased distention with fluid, are very superficial and without sacculations in their midst or diseased mucous membrane over their surfaces because cystitis has not yet occurred. Pathological trabeculations accompany other signs of obstruction, are due to hypertrophy of muscular bundles in overcoming the strain, do not change under increasing distention, are prominent and surrounded with sacculations of various depths, the mucous membrane is in a state of intractable chronic cystitis owing to the retention. Plugs of mucus and pus, also flakes and concretions of phosphatic precipitate, often are seen within the sacculations.

*Diverticula of the Bladder.*—Hypertrophy of the prostate is sometimes associated with diverticula as anatomical defects and not as acquired lesions through the disease of the gland. They are, therefore, strictly congenital and have all the characteristics assigned to them in the section on the Diseased Bladder in Cystoscopy. They are usually situated in the subperitoneal and urachal segments of the bladder which are relatively unsupported when compared with the uretero-trigonal and the retropubic segments which are respectively held more or less firm by the prostate and pubic symphysis, against pressure from within.

Sacculations of the bladder are probably for similar reasons more common in the subperitoneal and urachal segments than elsewhere. They are never seen excepting in association with prominent trabeculations and more or less cystitis. They are always acquired from obstruction, through strain and from inflammation.

*Retroprostatic Pouch.*—In hypertrophy of the prostate this depression occupies the subperitoneal segments almost entirely and lies behind the ureteric and interureteric folds. In the normal bladder this segment recedes at a slight angle below the level of the trigonum. As the prostate enlarges upward this declivity increases and as the ob-

struction of the prostate advances the pouching process begins behind this line where the strain is probably greatest to evacuate the bladder over the gland. This pouch is the seat of the residual urine with its precipitation of salts, chronic cystitis, sacculations and often diverticula. The retroprostatic pouch is the chief deformity of the bladder in prostatic obstruction and the chief seat of the secondary diseases of the bladder in this condition. It should be carefully studied under the limit of distention tolerated by the patient.

*Prominence of the Prostate.*—Hypertrophy in cystoscopy is noted as a whole for size, form generalized or lobular involvement, obstruction of the urethra, deformation of the bladder and lobulations with their relation to the urethra and ureters. In order to carry out this study the cystoscopist must be very familiar with his instrument, especially with the erect or inverted image they produce whose poles but not sides are reversed. The amount of magnifications should be known as well as comparison between the pictures of the near and remote image instruments. The retrovision telescope should always be used in confirmation of the findings. The Buerger cystourethroscope is of great value for study of the neck of the bladder and the prostatic urethra, when it may be introduced and manipulated.

*Charting of the Hypertrophy.*—Cystoscopy charts have been suggested by Young with the following general details: The cystoscope is withdrawn until the field is invaded by the gland for about half its extent, especially when the neck of the bladder is being inspected. The cystoscope is now rotated through 360 degrees, beginning, by preference in the writer's opinion, with the middle of the interureteric bar. Thus is revealed the prostate as a whole and the general location and features of any lobular enlargement are noted for description during the serial inspection, especially if either ureter is affected.

Young's chart for mapping the prostate consists of eight circles of the diameter of the cystoscopic field arranged in a circle and of sixteen similar circles in a square outside these. The author's method of systemic examination of the bladder, segment by segment, field-zone by field-zone, as described on p. 949, is essential for good results. Each segment is studied by withdrawing or inserting and then rotating the cystoscope to 45 degrees which will cover as much of the bladder as one of Young's eight circles. The insertion or withdrawal of the instrument reveals the anteroposterior features and the rotation the side to side features.

The eight circles will give the general outline of the prostatic condition while the features of a single lobe may be graphically detailed in the circles of the square corresponding with the central circle or circle which the lobular deformity appears as a whole.

At the center of the chart after the outlines have been inserted within the circles, a cross-section drawing of the posterior urethra may be placed after Young's method. In these cross-section diagrams it should be remembered that all convexities denote protrusions, all concavities mean depressions by prominence opposite them and all sulci occur between two protrusions or protrusion and a concavity.

In this accurate work the habit of beginning always at one point such as the middle of the interureteric bar should be begun and maintained.

Bilateral generalized hypertrophy of the prostate is shown perfectly by Young's chart. It will be noted that deep sulci are in the upper and lower polar fields and that all the other fields are greatly encroached by the gland. Therefore, in the center of the diagram a vertical slit represents the cross-section of the neck of the bladder and posterior urethra.

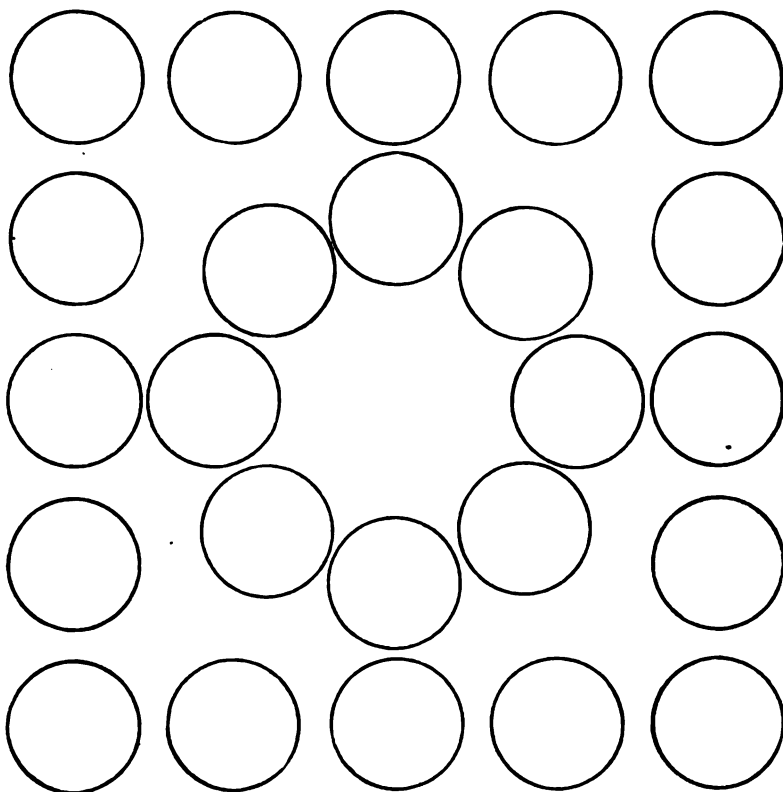


FIG. 346.—Young's chart of prostatic cystoscopic fields. The inner circle of eight fields gives the general survey of the prostate and neck of the bladder. The outer square of sixteen circles affords two extra views instead of one in quadrant, between the poles and the equator.

Marked median lobe hypertrophy of the prostate (at the expense of the roof) is also well charted. The lower polar field is nearly covered with the enlargement and the fields at either side of this show the sulci between the median and the lateral lobes which are practically without much change. In the center of the diagram, therefore, a crescent with the convexity upward is the cross-section of the urethra.

Median hypertrophy of the prostate (at the expense of the floor) is

rare but does occur with all the features of the foregoing diagram reversed. A crescent with the convexity downward therefore presents the cross-section of the urethra.

Bilateral and median hypertrophy of the prostate is also fully outlined. It will be noted that the upper polar circle shows the deep sulcus between the two lateral lobes, the lower polar circle is nearly covered with the prominence of the median lobe and the circles adjacent thereto contain the sulci between this and the lateral lobes. The arrangement within the urethra is practically three convexities about a common center.

This representation changes if one lateral lobe has escaped or if less enlarged on the principle that the convexity points toward the direction of growth and proceeds from the growing lobe. Thus diagrams might easily be shown of median with right lateral and of median with left lateral involvement.

Bilateral and confluent median hypertrophy gives a distinct diagram. It is noted that the upper polar circle alone contains a sulcus, that between the two lateral lobes, while the confluence between the median and the lateral lobes wipes out the sulci on each side of the lower polar circle. Cross-section of the urethra is therefore revealed as a deep, vertical slit leading from a contracted orifice.

Contracture of the neck of the bladder (without prostatic hypertrophy but with prostatic symptoms) will give a diagram showing encroachment of each field without sulci. Its cross-section would be a small, more or less regular circle.

The normal prostate gives a uniform picture with a slight convexity at the lower pole where the gland protrudes slightly into the bladder.

**Cautions in Cystoscopy.**—In hypertrophy of the prostate the dangers of instrumentation rest on the presence of complicating sequels, such as nephritis, pyelitis, pyelonephritis and pyonephrosis. Serious reflex effects on the kidneys may follow a cystoscopy in these complicated cases which are usually so advanced as to be beyond surgical aid, especially in the presence of advanced years. Fenwick<sup>1</sup> lays down the principle that a man of over forty-five years of age, presenting the nocturnal incontinence of prostatism and the great thirst of nephritis contraindicates cystoscopic investigations.

The prostate of such a patient may very well be outlined by a careful bimanual examination with considerable pressure upward of the rectal finger in order to bring the gland into closer reach of the abdominal hand.

Prostatics may be cystoscoped in this period of our knowledge when formerly they would not be so investigated. No force must be used, if possible no traumatism produced, and the investigation should be postponed until knowledge of the caliber, tortuosity and length of the urethra is fixed. In general a narrow, tortuous prostatic urethra in these cases, when combined with the complications and sequels of

<sup>1</sup> *Clinical Cystoscopy*, 1904, pp. 525 and 526.

damaged kidneys, is the chief element of danger. Many of the ordinary risks of cystoscopy in hypertrophy of the prostate are removed by lavage of the bladder before and after the instrumentation with silver nitrate solution, from 1 to 5000 to 1 to 1000, and by the preliminary and subsequent administration of urinary antiseptics internally. Acute and subacute symptoms of cystitis should be relieved as a preliminary, while rest in bed both before and after, and the judiciously copious drinking of water as a stimulant of the kidneys after instrumentation are very essential details of precaution and care.

**Diagnosis.**—The application of the x-ray to the recognition of hypertrophy of the prostate is comparatively recent in this country. Evans<sup>1</sup> says that in English the only important contribution is that of Hyman and Jaches.<sup>2</sup> Evans shows an x-ray photograph of a case of his own, seen in Fig. 347 and says: "The anteroposterior plate was negative for shadows, either of a calculus or any other shadow of pathological importance. The postero-anterior plate (see cut) shows a pear-shaped shadow, which was diagnosed as an enlarged prostate. The findings were verified by operation." Evans concludes that the best skiagram of the prostate is obtained with the patient lying on his belly.

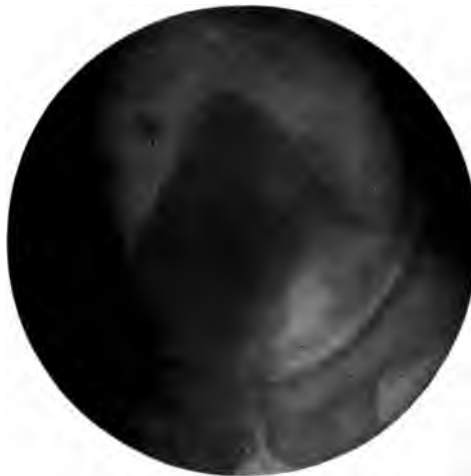


FIG. 347.—Posteroanterior plate of the bladder. The small round shadow to the right is a phlebolith. (Evans.)

Hyman and Jaches in the foregoing article simplified the older procedure of oxygen inflation by means of the complicated apparatus of Burkhardt and Floerchen. The method is of value when cystoscopy is impossible.

**Treatment.**—Like diagnosis, treatment must be abbreviated because these paragraphs deal chiefly with cystoscopy. The abortive measures are impossible in the nature of the chronic productive process

<sup>1</sup> Am. Jour. of Roent., April, 1917, p. 196.

<sup>2</sup> Surg., Gynec. and Obst., vol. xix, p. 409.



and prophylaxis is devoted to the possible complications, chiefly cystitis, ureteritis and nephritis through the administration of urinary antiseptics, attention to the action of the bowels and skin and through vesical irrigation with antiseptics. Palliation really extends prophylaxis in the proper application of catheter life, which is now nearly obsolete through the advantages of early diagnosis of prostatism, the recognition of complications and sequels and the proper selection of case for operation and the method of procedure. All these factors add to the safety of the operation.

The curative measures are only surgical. Foretreatment is all-important to prepare the patient and the urinary system for the operation. Among the older operations is the Bottini, which cauterizes the neck of the bladder without perineal drainage. It has served its day and is now rarely used, having been supplanted by Chetwood's<sup>1</sup> perineal galvanoprostatomomy which adds perineal section and drainage to cauterization. This operation is also nearly obsolete and is useful chiefly in contracture of the neck of the bladder without prostatism. Prostatectomy by the suprapubic route of Fuller<sup>2</sup> in this country and of Freyer<sup>3</sup> in England, or by the perineal route of Young<sup>4</sup> in this country is the operation of choice. The two-stage suprapubic prostatectomy has been further developed by Pilcher<sup>5</sup> more than any one else in the United States. The details of these operations are omitted in the nature of these chapters on cystoscopy.

*Braasch Excisor.*—An improvement on the Chetwood and Young methods is that of Braasch.<sup>6</sup> "The instrument consists of three separate sheaths of decreasing caliber which are so arranged that the smaller sheath fits into the next larger. The outside sheath (*A*) is practically a urethroscope. The light is situated at the distal end in the beak, and it has an irrigating cock near the proximal end. The window is of plain glass without magnification and fits all three sheaths. The observer looks through the tube filled with water, after the principle employed in my irrigating cystoscope.<sup>7</sup> After the obstructing tissue is brought into view, the second sheath (*B*) is introduced. This has a collar at its distal end which is armed with two irregular teeth by means of which the tissue is held in place. The latter procedure is also under the guidance of direct vision. Then the inner or knife sheath (*C*) is introduced and the tissue cut while still in view. The blood from the wound is usually washed from the field by the rapidly entering irrigating fluid. The advantages of this instrument are obvious. Without a visualized field, unless the operator is very expert, it is evident that the base of the bladder instead of the median bar might easily be cut."

*Aftertreatment.*—The wound, the bladder and the urethra all require attention. As a rule, the wound is healed in from three to eight weeks.

<sup>1</sup> Am. Assn. of Gen.-Urin Surgeons, 1901, and Med. Rec., 1901.

<sup>2</sup> Jour. Cutan. and Gen.-Urin. Diseases, June, 1895.

<sup>3</sup> British Med. Jour., 1901, ii, 125.

<sup>4</sup> Jour. Am. Med. Assn., 1903, xli, 999.

<sup>5</sup> Surg., Gynec. and Obst., February, 1917, xxiv, 163.

<sup>6</sup> Jour. Am. Med. Assn., vol: lxx, No. 11, p. 758.

<sup>7</sup> Am. Jour. Urol., 1912, viii, 115-119.

on with one or several relapses of the sinus and finally with total cure. The wound is allowed to heal by granulation on general surgical principles, being kept clean by frequent changes of dressings

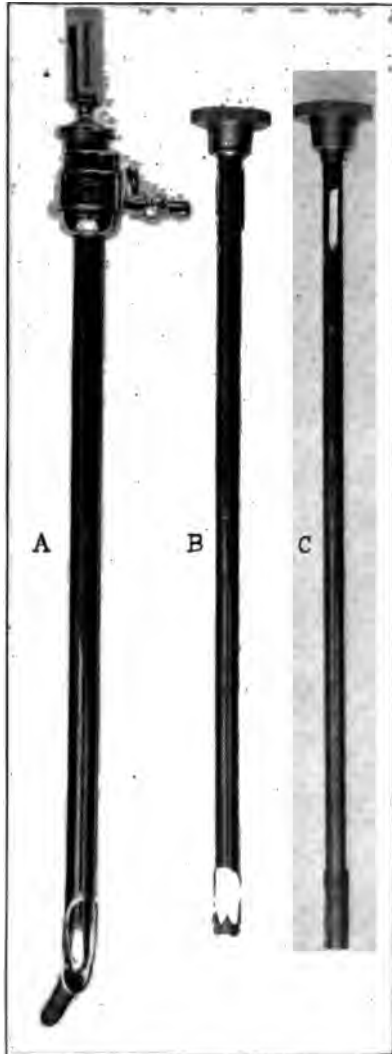


FIG. 348.—Median bar excisor. (Braasch.)

various forms of drainage. Morton<sup>1</sup> employs a single 16 C.P. incandescent electric lamp under an ordinary fracture frame covered with bed clothing and sufficiently near the wound to give gentle heat.

At a personal demonstration to the author at his clinic at the Long Island College Hospital, May, 1917.

The period of application of an hour or two is followed by one of rest. The wound is not covered with any dressing and is found by Morton to be stimulated greatly by this simple procedure. Hemorrhage after prostatectomy is often very troublesome. Among the means of arresting bleeding one of the best is the bag of Pilcher.<sup>1</sup> Like all similar devices it has its limitations and cautions but is undoubtedly serviceable.

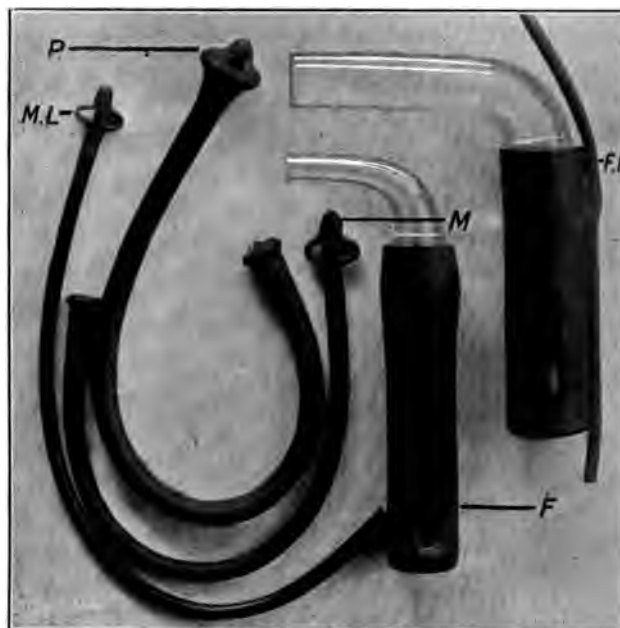


FIG. 349.—Urethral and suprapubic vesical drains. *M* is the Malécot catheter; *P* is the Pesser catheter and *M.L.* is the Malécot-Lebreton catheter whose shaft is woven silk and eye soft rubber. *F* is the Freyer suprapubic drain with glass elbow and *F.I.* is irrigating pattern of the Freyer tube, whose small inlet should be shortened to the length of the large segment.

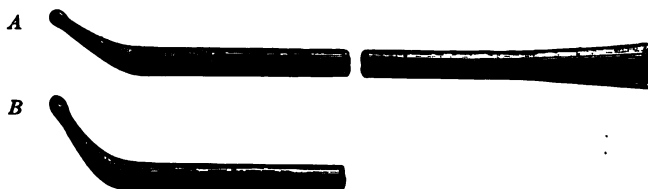


FIG. 350.—Pasteau olive-pointed, single elbow, double eye, cylindrical catheter; *A* with 35 degrees and *B* with 45 degrees angle of tip.

The device is a simple inflatable rubber bag, fashioned about a large size catheter.

The open tube catheter is entered first through the suprapubic wound, over a silver catheter, and drawn down through the urethra.

<sup>1</sup> Surg., Gynec. and Obst., February, 1917.

When the bag is in the bladder with the tube in the urethra, the bag is inflated through the inflating tube, and the inflated bag is used for pressure against the bleeding surface from which the prostate was removed.



FIG. 351

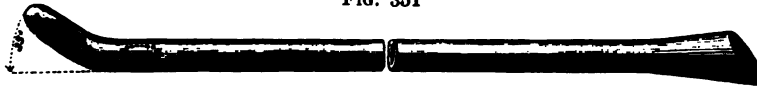


FIG. 352

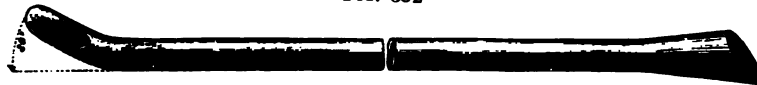


FIG. 353

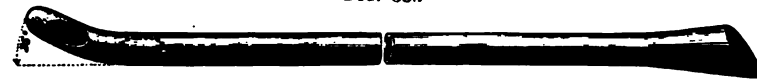


FIG. 354

FIGS. 351-354.—Elbow woven silk catheters. Round tip, single elbow, double eye model; showing from above downward the 40, 35, 30 and 25 degrees angle of the elbow.

When pressure is desired, the catheter attachment is pulled upon, which brings the bag more tightly into contact with the bleeding surface. This pressure may be maintained by attaching the catheter tube to the leg. The catheter tube also acts as an avenue for the escape of the urine from the bladder.



Fig. 355 is the double elbow, double eye form. The shafts of these instruments are cylindrical, oval from side to side and oval from top to bottom according to choice.

By this means a safe and positive hemorrhage control is provided which may be removed within an hour, if desired, and reapplied at will, without disturbing the patient. Its removal at the same time that the drainage tube is changed is accomplished with relatively little discomfort to the patient.

**CHRONIC PROSTATITIS.**

**Varieties.**—Chronic prostatitis is catarrhal, in which infectious pus is more or less absent but replaced by mucopus, and suppurative, in which the reverse condition obtains with the added tendency to septic symptoms. Chronic suppurative prostatitis is sometimes accompanied by lithiasis of the prostate. To the cystoscopist both forms present about the same condition.

**Cystoscopy.**—In chronic prostatitis the cystoscope reveals a rather difficult insertion of the instrument usually through infiltration and rigidity of the canal through the same conditions of the gland which encroaches on the prostatic urethra as a whole. The bladder as a whole is normal except where in direct contact with the diseased prostate. The trigonum is hyperemic, swollen, edematous, infiltrated and prominent. The neck of the bladder is thickened, indurated and may show the "prostatic bar."

**Cystourethroscopy.**—When the instrument may be passed in chronic prostatitis it verifies all the foregoing findings as a close vision instrument, and adds the minute study of the neck of the bladder and prostatic urethra which frequently shows edema, hyperemia, cystic degeneration and enlarged follicles from which pus may often be seen extruding into the field or by rectal pressure may be squeezed out.



FIG. 356.—Median lobe of prostate. (Author's case.)

**Author's Seven-glass Test.**—In chronic prostatitis this multiple glass test is a valuable aid in diagnosis. The anterior urethral and control glasses will be clear, the posterior urethral glass turbid and contain characteristic prostatic elements, the bladder glass will be clear, and the massage glass loaded with prostatic elements. If cystitis is present also, as in some cases, the bladder glass will also be turbid but free of prostatic elements, containing only bladder detritus.

Another advantage is the distinction of the vesicles from the prostate

and from each other in the contents of Glasses V, VI and VII, respectively, taken from the prostate and each seminal sac. The details of this test are described on page 455.

Median lobular hypertrophy of the prostate differs from chronic prostatitis in cystoscopy in that the lobe may overlie but does not usually change the trigonum. The prostatic urethra is changed in much less degree so that the entering instrument encounters there no obstruction, but only in the bladder as it passes to either side or over the median lobe.

### TUBERCULOUS PROSTATITIS.

**Cystoscopy.**—In tuberculous prostatitis cystoscopic investigation has an element of risk of infecting the bladder which may previously have escaped. Tuberculous prostatitis without vesical symptoms is often regarded as a contraindication to cystoscopy, but the preliminary administration of urinary antiseptics and the subsequent lavage of the bladder are usually sufficient to meet this danger.

Tuberculous prostatitis with vesical symptoms is, on the other hand, a direct indication for cystoscopy, and reveals absence of true hypertrophy of the gland, either lobular or generalized, but irregular enlargement covered with granular, hyperemic mucosa with hemorrhagic tendencies and occasional ulcers and tubercles.

**Cystourethroscopy.**—When the insertion of the cystourethroscope is possible, display the tuberculous conditions in the urethra, in many cases as shown in Fig. 214. Tubercles may be found and the discharge of pus from the follicles and ducts observed or induced by rectal touch.

The bladder as a whole usually escapes any findings for the cystoscope excepting the conditions described overlying the prostate itself. Severe lesions belong to advanced cases.

**Caution of Cystoscopy.**—Tuberculous prostatitis requires irrigation of the bladder and the urethra with antiseptics of mild type as the final step, as suggested in the discussion of tuberculous cystitis.

**Rectal Examination.**—The tuberculous prostate shows a gland whose surface is granular and nodular and whose enlargement is without order. Sensitive soft spots are found and the Wolbarst five-glass test is abundant in pus in the prostatic urethral glass and in the massage glass, in which tubercle bacilli may commonly be discovered by bacteriology and animal experimentation.

### NEOPLASM OF THE PROSTATE.

**Varieties.**—Neoplasm of the prostate in cystoscopy includes only carcinoma and sarcoma. Carcinoma alone is important as sarcoma is very rare, even in old age, although in childhood it is practically the only neoplasm of the prostate.

**Cystoscopy in Carcinoma.**—The cystoscope in cancer of the prostate is far from satisfactory as a means of diagnosis because the interior of the bladder is changed late in this disease. Rectal touch is of more value in





X

FIG. 357.—Autopsy specimen. Bladder opened. Ulceration around internal urethral orifice (X).



X

FIG. 358.—Autopsy specimen, showing extensive involvement of the prostate. X, urethral orifice.

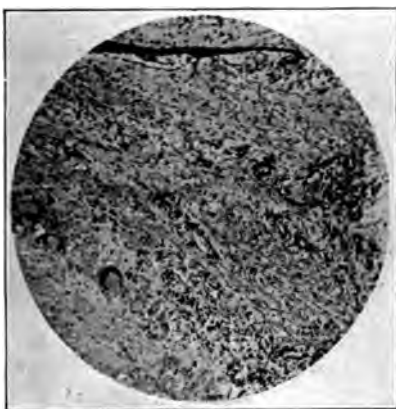


FIG. 359.—Koll's case, showing tubercle with giant-cells and caseation; also prostatic tubule with amyloid body.



FIG. 360.—Koll's case, showing formation, caseation and some normal prostatic tubules.

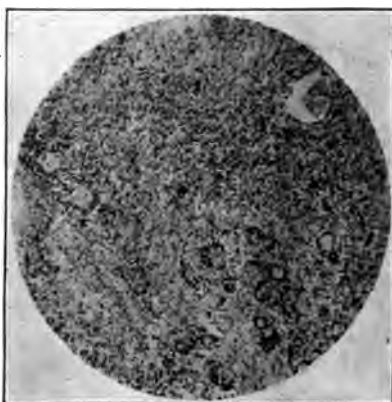


FIG. 361.—Koll's case, showing high degree of infiltration.

FIGS. 357-361.—Primary tuberculosis of the prostate gland. (Koll<sup>1</sup>).

<sup>1</sup> Ann. Surg., vol. xxxvii, No. 5; Tr. Am. Urol. Assn., 1915, ix, 365.

reaching the deposits of the growth at the posterior commissure of the gland where it commonly begins. From this point it invades the glandular substance *per se*, after which operation becomes of little value. When the gland has become invaded more or less deformity of the bladder floor with residual urine, cystitis and many other symptoms of senile hypertrophy of the prostate may supervene.

The discovery of a very hard, stony gland in part or in whole through the rectum and of the conditions within the blood suggesting carcinoma, are more reliable for diagnosis than cystoscopy.

Carcinoma starts in the posterior commissure of the prostate and has a definite tendency to early fixation of the gland, hence, when this fixation is present as distinguished from the mobility of even large hypertrophies, the diagnosis of malignancy may be regarded as definite.

**Radium Treatment of Cancer of the Prostate.**—This subject has offered little encouragement until Barringer<sup>1</sup> developed the plan of loading a needle with radium and carrying the same into the substance of the glands; his technic is described in the foregoing article in the following terms:

*“Technic of Application of Radium.*—Because the carcinoma starts in the interior of the prostate gland, and radium by urethra or rectum often causes intense irritation, I have applied the radium differently. A needle 41 inches long and about 18 gauge has been used. From 50 to 100 millicuries of radium have been placed in the end of this needle for a distance varying between  $\frac{3}{4}$  inch to  $1\frac{1}{2}$  inches according to the indications of the individual case. The patient is placed in a lithotomy position, a finger introduced into the rectum and the perineum between the urethra and rectum is anesthetized with novocain (1 per cent.). I have frequently inserted the needle without anesthetization, causing very little pain. The radium needle is then plunged into the perineum between the urethra and rectum, and, guided by the rectal finger, the end of the needle is passed into the middle of one or the other of the carcinomatous lobes.<sup>2</sup> After the needle is introduced, the patient frequently does not feel its presence. The needle is left in place from four to six hours. If one wishes to irradiate the other lobe, the needle is pulled out of the first lobe and introduced into the second and left there the proper time. The ease of this procedure is obvious. I was nearly dissuaded from using this method by reports of necrosis following the use of unscreened radium. I have now used the needles in the prostate fifteen times, and to date have had no radium sloughs. These patients are apt to have burning and pain beginning the week after the radium is used and lasting for from one to two weeks. During this time the prostate swells, and the maximum effect of the radium on the growth is not to be looked for until two or three months. Some patients, notably those with the carcinoma extending into the vesicles, have a great deal of pain. Neither the pain, however, nor the urinary dis-

<sup>1</sup> Loc. cit.

<sup>2</sup> The needle in the prostate also serves to exclude prostatic stone, the one condition hard to differentiate from carcinoma.

turbance is as great as when the radium is used in the bladder. And curiously enough, radium in the urethra seems to cause or increase an already present residual urine; while this needle method, as far as I have observed, does not. There is a certain class of borderland cases in which the carcinoma has broken through into the bladder neck and in which it is a question whether to use the prostate needles or the screened radium in the bladder neck. I think these cases should be started with prostate needles, as the reaction is often little or nothing."

**Differential Diagnosis.**—Prostatic disease involves chiefly its distinction from various vesical lesions, because the early subjective syndrome of prostatic involvement is vesical and only in later as the disease advances are the urethra, ureters and kidneys included. The most important vesical conditions for consideration are vesical calculus, neoplasm paralysis, and contracture of the neck of the bladder.

Vesical calculus differs from prostatic disease in the findings by the cystoscope, the stone searcher and rectal and bimanual examination. There is no enlargement of the gland except by congestion. Cystitis is commonly an earlier and more marked lesion and sometimes the concretion may be perceived between the hands in a bimanual examination. The subjective symptoms are those of congestion and irritation of the bladder floor and prostate with nocturnal and diurnal pollakiuria so as to make distinction from early prostatic hypertrophy most difficult. In advanced life vesical lithiasis may precede prostatic change with little cystitis or at most one of low grade, with very slow development of the stone.

In true hypertrophy of the prostate stone is often present and not suspected or found until operation, or even at that time overlooked unless care be taken to feel for stones *before the enucleation*. The stone is usually free in the retroprostatic pouch or more or less fixed in a sacculum secondary to chronic cystitis, or in an anatomical diverticulum. With the cystoscope in place and the stone in view, its mobility and freedom from such attachments may be demonstrated by lifting the prostate or bladder with the finger in the rectum. Stone as a sequel of prostatic enlargement and cystitis occurs in about one-fourth of all patients.

*Vesical neoplasm differs from hypertrophy of the prostate* chiefly in the cystoscopic demonstration. This is easy if the base of the tumor may be studied and shown to be embedded in normal mucous membrane. The direct-vision and close-vision instruments are very serviceable for this point. Implantation of the tumor at any part of the bladder except the trigonum over the prostate in particular is a distinguishing element.

Benign papilloma of the bladder has its own characteristics, as previously described in this subject.

Ulcerating papillary carcinoma with its sessile base, earlier cystitis and frequent attachment around the trigonum is far more difficult of diagnosis unless the mucous membrane is still normal and may be followed up into the base of the neoplasm.

Infiltrating carcinoma, if in the trigonum, cannot be distinguished from prostatic conditions.



*Paralysis or paresis of the bladder wall differs from hypertrophy of the prostate* in having a negative rectal and bimanual examination and at least, in the early cases, of always showing a cystoscopic picture of normal mucosa throughout the bladder cavity and of a prostate without general or median lobe involvement. The reason for the symptoms of prostatism are that the weakness or paralysis of the bladder muscle prevents total and permits only partial evacuation of its contents. If the residual urine is large in quantity, and a cause of cystitis exists and this lesion supervenes, then the picture of prostatic disease is almost typical. The commonest source of such a bladder is *tabes dorsalis* and, of course, is of syphilitic origin. The presence of the physical signs and symptoms of *tabes* preceding and accompanying such bladder symptoms is usually the diagnostic point.

### CONTRACTURE OF THE NECK OF THE BLADDER.

**Synonym.**—Prostatism without enlargement of the prostate is the other term usually applied to this condition whose clinical signs so closely simulate those of true hypertrophy of the prostate that it must always be considered when other signs of hypertrophy are lacking and when a history of chronic inflammation is given. Chetwood<sup>1</sup> has studied this condition very thoroughly and points out that Guthrie,<sup>2</sup> 1836, Mercier,<sup>3</sup> 1856, Sokell,<sup>4</sup> 1874, Civiale,<sup>5</sup> Von Frisch,<sup>6</sup> 1899, and Sir Henry Thompson<sup>7</sup> have all more or less deliberately and definitely described it.

**Etiology.**—Contracture of the neck of the bladder is usually independent of but may be identified with true hypertrophy of the prostate and complicate the picture thereof. The essential factor is chronic, deeply seated, suppurative inflammation followed by chronic productive inflammation on either the vesical or the urethral surface of the neck of the bladder or both.

**Pathology.**—Contracture of the neck of the bladder varies with the presence or absence of prostatic hypertrophy.

If the prostate itself is normal, the pathology is that of chronic suppuration and infiltration with secondary fibrous contracture. The overlying mucosa in either or both bladder or urethra is thickened and polypoid, the muscle body is invaded by the sclerosing process, the vesical outlet is deformed, elevated, displaced and more or less or sometimes totally closed. In short, the condition is that of stricture of the urethra located in or about the outlet of the bladder and its muscle.

<sup>1</sup> The Practice of Urology, 1913, p. 435.

<sup>2</sup> London, 1836; Lectures, vol. xvi, p. 271.

<sup>3</sup> *Récherches Anatomiques, Pathologique et Thérapeutiques sur les Maladies des Organes Urinaires, Génitales, etc.*, Paris, 1841, ix, p. 372, also *Récherches sur le Traitement des Maladies des Organes Génito-urinaires*, 1856.

<sup>4</sup> Thèse de Paris, 1874.

<sup>5</sup> *Traité Pratique sur les Maladies des Organes Génito-Uriinaires*, Paris, 1841, II, v, 241-256.

<sup>6</sup> *Krankheiten der Prostata*, ii, 1910.

<sup>7</sup> *Diseases of the Prostate*, Prize Essay, 1856, xvii, p. 293.

If true hypertrophy of the prostate is coexistent all its characteristic progressing pathological signs are added to those of the contracture at the vesical neck.

**Subjective and Objective Syndromes.**—The subjective symptoms are practically identical with those of stricture of the urethra or of early prostatic hypertrophy, nocturnal and diurnal frequency of urination, occasional involuntary emptying of the bladder, dysuria, hesitation in starting, decrease in the size and force of the stream primarily due to the obstruction and secondarily due to the atony of overstrained muscle.

Objective symptoms of contracture of the neck of the bladder vary with the absence or presence of hypertrophy of the prostate.

If the prostate is not enlarged the urethra is free of obstruction up to and usually through the sphincter, a blunt point sound being momentarily arrested, then suddenly jumping over the constriction. A short-beak stone searcher passes in the same manner and when reversed with its beak backward, catches at a distinctly narrow ridge on being withdrawn. The urethral length is unchanged.

With prostatic hypertrophy present all the characteristic symptoms and signs of this condition are added to those of the constriction at the neck of the bladder.

**Cystoscopy.**—Urinalysis shows a normal bladder except in late cases with secondary cystitis. In contracture of the neck of the bladder cystoscopy is best performed with close-vision instruments, such as the Acmi or Chetwood convex sheath types, or better, with the Buerger cystourethroscope as this permits examination of the urethra at the same sitting.

The muscle is found to present a prominent, fixed, irregular, inelastic, congested or pale, elevated margin. Within the bladder around the sphincter and within the prostatic urethra distal to it, the mucosa is in a state of chronic congestion or inflammation, or more or less pale from the sclerosing process, much as is seen in stricture of the urethra at other points.

**Diagnosis.**—The diagnosis of contracture of the neck of the bladder rests on the absence of tabes dorsalis or other form of spinal paralysis and stricture of the urethra as the other common causes of retention of the urine, and on the presence of a urethra with normal caliber and length and a prostate without hypertrophy.

The contracture itself must be instrumentally determined. The common sound with blunt point will usually enter easily after a brief hesitation followed by a slip over the puckered muscle. The short stone-searcher of Thompson recognizes the same condition and proves it by hooking upon it if withdrawn with its beak turned backward into the middle line. Palpation with the stone-searcher of the bladder floor eliminates intravesical hypertrophy of the prostate.

Cystoscopy confirms these findings by adding a normal bladder as a whole and no prostatic change.

Operation adds the final step in diagnosis. The normal outlet of the

bladder is to the operating finger firm and elastic but when contracture of the neck exists a hard, inelastic bar is felt which is passed with difficulty at best, or with tearing if force is used, or may even be impassable.

Contracture of the neck of the bladder should therefore be thought of in any subject showing the symptoms of prostatism with an unchanged gland.

**Dangers.**—That the Young prostatic punch may result in serious accident if its teeth are bent outward is shown by the report of Swinburne,<sup>1</sup> "after the insertion of the instrument while it was in the bladder, and then withdrawing it, instead of catching the bar it slipped into the urethral canal and caught about four inches from the meatus. I noticed, on inserting the instrument, that it was rather tight at that point. I could not move the instrument either way. I attempted to shut the knife down and perhaps cut off that bite. It did not do anything. There was nothing to do but perform an external urethrotomy. When I got the instrument out I found that one of the teeth had been turned a little bit outward."

### LITHIASIS OF THE PROSTATE.

**Occurrence.**—Stone in the prostate is rare but its significance is great. Multiple small stones are the rule, as shown in the author's specimen, Fig. 362.

**Varieties.**—Primary cases are practically unknown, as all have antecedent infections. The disease is never acute but may have severe symptoms by recent or relapsed infection. It is essentially chronic like lithiasis elsewhere.

**Etiology.**—As in all other lithiasis the exact cause is unknown but the factors are probably a gland damaged by old disease or changed by hypertrophy with infection precipitating the chemical elements of the normal fluid.

**Pathology.**—The stones occur by precipitation in the acini of the gland and usually in one lobe or part of a lobe rather than in the gland as a whole. There are no temporary lesions except the accompanying infection which may recover after the stones are removed, leaving behind them, however, changes in the gland similar to those seen in the kidney, for example, by the formation pressure and attrition. The associated conditions are the cystitis and other ascending infection and the chronic posterior urethritis seen with other prostatic conditions.

**Symptoms.**—To those of prostatic hypertrophy are added the results of the stones: Pain, bleeding, discharge, pollakiuria, tenesmus and the passing of stones. The pain is usually deep seated, perineal, increased by urination, defecation and attempted coitus. It is most marked when a stone is being passed, and is then urethra. The bleeding is often only microscopic but may be copious, especially after straining at stool or

<sup>1</sup> Tr. Am. Urol. Assn., 1915, ix, 289.



other trauma. The discharge is urethral, moderate or marked and usually infected with various organisms. The pollakiuria and tenesmus rest on the physical and reflex irritation of the stones and the accompanying cystitis. The passing of stones is variable. The author's specimen, out of more than a hundred, numbers well over thirty stones almost painlessly passed by an old man.

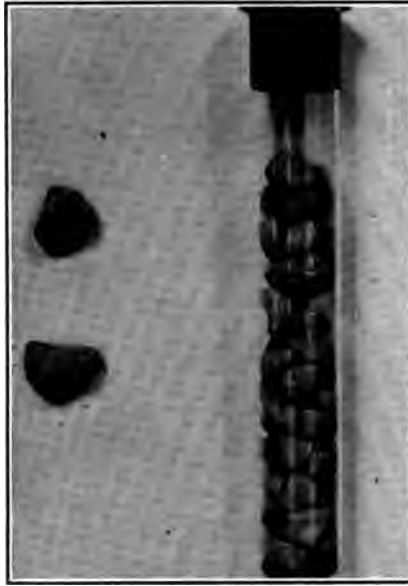


FIG. 362.—Prostatic calculi. Voluntarily voided, often impacting in the urethra, making them temporarily urethral calculi; weight 7.36 grammes; composition urethrostic and urate salts; occurrence in a sailor, aged eighty years, in robust health other than enlarged prostate with cystitis; specimen one-fourth of whole quantity passed. (Author's case.<sup>1</sup>)

The objective symptoms are those of the enlarged prostate with hard discrete nodules or crepitating masses, positive urethroscopic and cystoscopic examination, *x*-ray verification and occasionally impact on sounds for other exploring instruments. Impacted stones are occasionally palpated or urethroscoped. Discharge may be studied as in urethritis and the dysuria and tenesmus noted.

The termination of these cases is advancing suppuration, complicating infections, and destruction of part or all the gland in neglected cases. Treatment may restore reasonable local and bodily health.

**Diagnosis.**—The history, subjective symptoms, objective symptoms, urethroscopy, cystoscopy and roentgenology settle the question. Some stones are silent and discovered at operation.

**Treatment.**—As soon as the diagnosis is made the stones should be removed by prostatotomy in mild cases, occasional during sexual life or by prostatectomy in severe cases in age.

<sup>1</sup> Loc. cit.

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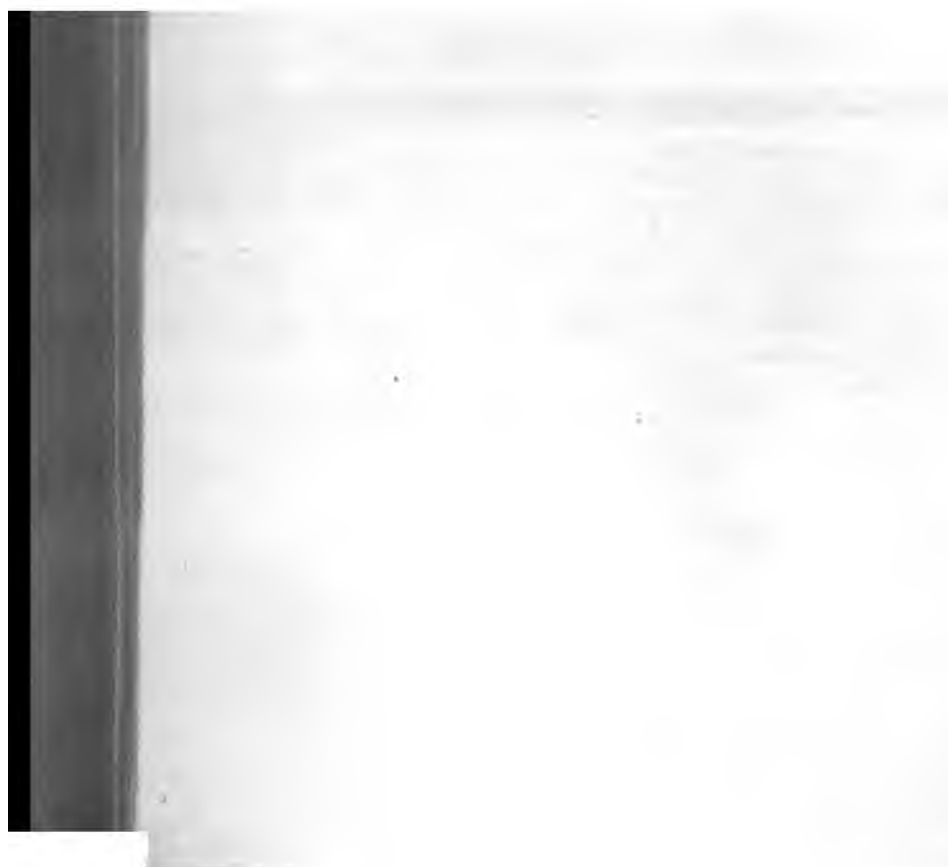
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